Environmental Innovation and Societal Transitions 33 (2019) 162–182

Contents lists available at ScienceDirect

Environmental Innovation and Societal Transitions

journal homepage: www.elsevier.com/locate/eist

# How the regime hampered a transition to renewable electricity in Hungary

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ARTICLE INFO

*Keywords:*
renewable energy
political economy
regime resistance
media
illiberal democracy
Central and Eastern Europe

ABSTRACT

With respect to wind and solar electricity, Hungary is a laggard in the European Union. Key geographical and economic factors fail to explain this. Using the multi-level framework, I rely on technological and policy documents, 21 expert interviews, and more than 1500 news pieces to better understand why the breakthrough of wind and solar energy has not happened yet. I show why the nuclear industry and the government, understood as one regime, could respond to niche developments and landscape changes. Early actions by the regime, limited media discussions, weak landscape pressures, and various mechanisms that characterize illiberal states were responsible for this. While motivations of the regime are not disclosed, potential reasons for the broad energy policy directions are discussed. The article highlights socio-political aspects of the compatibility of nuclear energy and renewables, and calls attention to differences between liberal and illiberal states in both transition processes and their analysis.

## 1. Introduction

The Energy Roadmap of the European Union lays out an ambitious plan to achieve 80-95% reduction of greenhouse gas emissions by 2050 compared to the 1990 level (ECF, 2010). This is unimaginable without a fundamental transition of energy systems (GEA, 2012). Until now, the fastest change in several European countries has been observed in the electricity sector. The most widely discussed example is Germany, where in the 15 years after 2000 the share of renewable sources increased from less than 7% to almost 30% (AGEB, 2016). The speed of change has also been impressive in Denmark, Sweden, Spain and Portugal. Other member states, however, are moving much slower. For instance, several countries in Central and Eastern Europe (CEE) have added very little low-carbon capacity recently, especially neglecting intermittent renewables which have the largest growth potential.

Hungary is an excellent example: its combined per capita electricity generation from wind and solar sources has consistently been among the lowest in the EU since 2010 (Eurostat, 2017).[1] This is surprising because–seen from a distance–Hungary does not look like the most inhospitable place for wind and solar energy within the EU. There are many more sunny hours than in Germany (Šúri et al., 2007) where solar is booming, the per capita technical potential of onshore wind energy is not substantially below the EU average (EEA, 2009), and the utilization factor of existing wind turbines is similar to those in other European countries (EIA, 2015; MAVIR, 2015). Likewise, the low level of investment cannot be easily explained by economic factors because Hungary is not the poorest country in the EU. Romania and Bulgaria, where the average income is much lower, had five times higher per capita production from wind and solar in 2015 (Eurostat, 2017). Furthermore, Hungary imports over 30% of its electricity (Eurostat, 2016) and most of its

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[1] Since 2012, only Malta and Latvia had lower per capita production in any year.

https://doi.org/10.1016/j.eist.2019.04.004
Received 5 January 2018; Received in revised form 12 April 2019; Accepted 18 April 2019
Available online 31 May 2019

fuels used for electricity generation, which could be a good reason to develop renewables (Eikeland and Sæverud, 2007) in a country that is officially committed to reducing energy dependence (NFM, 2012). In addition, modelling results show that significantly increasing production from renewables would be technologically feasible (Kiss et al., 2016; Lechtenböhmer et al., 2016).

So, what explains the low penetration of wind and solar energy in Hungary? The present study looks at the main factors and mechanisms that might be responsible for this. Technological and institutional lock-ins (Unruh, 2000), policy barriers (Reiche and Bechberger, 2004), and different aspects of regime resistance (Geels, 2014) are analysed using the theoretical framework of the multi-level perspective (Geels, 2018, 2002). The aim is to understand the country-specific dynamics of co-evolutionary change (Foxon, 2011; Unruh, 2000).

As part of this analysis, a second aim is to investigate how competition with nuclear energy affects intermittent renewables. This is particularly interesting since Hungary decided to build two new nuclear reactors until the 2020s. Previous studies suggested that a high share of nuclear energy in the power mix hinders renewables (Aguirre and Ibikunle, 2014; Kilinc-Ata, 2016; Marques et al., 2010; Popp et al., 2011; Romano and Scandurra, 2016) and questioned their compatibility in future electricity systems (Verbruggen, 2008), while others argued for their simultaneous use (Clack et al., 2017; Williams et al., 2012). Showing how a new nuclear project and intermittent renewables interact and exposing the factors that affect these interactions can be relevant for other countries with nuclear ambitions.

A third aim is to gain insights regarding the analysis of transitions in an "illiberal state" (Zakaria, 1997), which is a hybrid system somewhere between liberal democracies and dictatorships (Bozóki and Hegedűs, 2018). In 2000 when the analysis begins, Hungary looked like one of the most successful countries in terms of both economic restructuring and commitment to democratic values from the recently democratized Eastern bloc (Schimmelfennig, 2007). Corruption, large political scandals and the effects of the financial crisis eroded this position over the next decade (Batory, 2010; Darvas, 2008). After 2010, an outright turn away from liberal democracy has taken place, which meant centralized decision making in most areas including energy policy (Bozóki and Hegedűs, 2018; Csoma, 2017; Kornai, 2015). Increasing centralization has consequences for certain transition processes and for the level of understanding that is achievable through analysis. This can be interesting today when the liberal consensus–the almost universal agreement on the superiority of liberal democracies–seems to be fading away (Dawson and Hanley, 2016; Enyedi, 2016).

The article combines three research methods. First, it collects historical information on the electricity system from technical and policy documents. The focus is on the period 2000-2015 because solar and wind capacities were negligible earlier. Second, 21 semi-structured interviews conducted with leading electricity experts are used. The interviews explored perceptions regarding the most important processes and explanatory mechanisms as well as regarding possible outcomes of domestic and European energy policy. Third, the coverage of solar, wind and nuclear energy is reviewed in the archives of the most popular Hungarian online news portal from 2000 to 2015. The analysis of more than 1500 articles reveals the level and dynamics of media attention given to the studied power sources. To my knowledge, this is the first broad multimethod analysis of energy system transitions in a CEE country, and potentially the first such case study in an illiberal context.

The investigation of a blocked breakthrough is very important because a main reason to study energy transitions is the insufficient speed of change from a sustainability perspective (BNEF, 2016; GEA, 2012; Temple, 2018) and because the literature is strongly biased towards successful transitions (Geels, 2018). I show why the regime, understood as the nuclear industry and the government at any point in time, could prevent the breakthrough of the wind and solar niches. The main reasons include early actions by the regime to create techno-institutional lock-in (Unruh, 2000), a media environment that did not help to change visions of energy futures (Teräväinen, 2018), weak landscape pressures, and various institutional strategies of the illiberal government that limited the effectiveness of any possible contenders such as journalists, the opposition, pro-renewable lobbies, experts, non-governmental organizations (NGOs), and the general public. I further discuss potential motivations of the regime to block the breakthrough, and highlight limitations of understanding transition processes of illiberal states.

The rest of the article is organized as follows. Section 2 describes the research framework and methods. Section 3 summarizes the combined results of document analysis and interviews. Section 4 reports the results of the media analysis. Section 5 discusses the findings. Section 6 concludes.

## 2. Research framework and methods

### *2.1. Research framework*

The multi-level perspective (MLP) (Geels, 2002) is used as a theoretical framework to analyse the transition processes, or their absence, in Hungary. The MLP differentiates three levels: small-scale niches, where radical innovations often emerge, the incumbent regime, which has the power to interfere in transition processes, and the sociotechnical landscape, which provides a broader context influencing the conditions under which change can happen. Sociotechnical transitions come about through interacting processes within and between these levels (Geels et al., 2016; Geels and Schot, 2007). The present study investigates interactions between the three levels in the case of a blocked transition, in contrast with the majority of MLP studies that focus on singular niche innovations and successful transitions (Geels, 2018). Studying such negative cases where a transition looks possible or even likely is very important for both theory building (Mahoney and Goertz, 2004), and for a practical understanding of how energy transitions are slowed down under specific circumstances (Geels, 2014; Unruh, 2000).

From the massive literature on the MLP which has been repeatedly reviewed (Geels, 2018, 2011; Genus and Coles, 2008; Smith et al., 2010), the much more limited discussion of regime-to-niche interactions is of particular importance here. Previous studies on regime behaviour do not form a coherent body of literature (Smink et al., 2015), and explicit connections with the MLP are rare

(Geels, 2018). While it is clear that incumbents use various means including information strategies and lobbying to influence or block transitions (Andrews-Speed, 2016; Geels, 2014; Hillman and Hitt, 1999; Newell and Paterson, 1998; Smink et al., 2015), these behaviours are often difficult to directly investigate because at least some of the activities are secretive (Brulle, 2014; Cho et al., 2006; Smink et al., 2015). Rather than attempting a comprehensive analysis of the overt or covert strategies used in Hungarian power struggles, I describe the outcomes of these struggles in terms of policy changes, technological decisions, and media representations. I show how and why the regime could keep the niches under control despite significant changes of the landscape favouring a transition. Then I discuss possible explanatory mechanisms of regime behaviour, i.e. why the regime wanted to block these niches. From the various classifications of forms of power in transition processes (Avelino and Rotmans, 2009; Geels, 2014; Hall, 1997; Kern, 2011; Levy and Newell, 2002; Newell and Paterson, 1998), I follow Hall (1997) and Kern (2011) by distinguishing three channels through which directions of change can be influenced. First, the material or political *interests* of agents, which are considered crucial by realist theories (see e.g. Blyth, 2003) and play some role in virtually all explanations of regime resistance (e.g. Geels, 2014; Unruh, 2000). Second, the *ideas* that shape discourses in policy making and general public discussions, including the purposeful selection of topics and interpretations that build or destroy the legitimacy of given technologies (Antal and Karhunmaa, 2018; Geels and Verhees, 2011; Hermwille, 2016; Rosenbloom et al., 2016). Third, *institutions* such as rules, regulations and permitted channels of action that constrain agency and transition processes (e.g. Andrews-Speed, 2016; Smink et al., 2015). In the following analysis, nuclear energy is discussed as the most important technology supported by the industrial and political regime, while the two niches considered are wind and solar energy. Although it is clear that regimes are often not entirely coherent in terms of interests, preferred discourses, or institutional strategies (Fuenfschilling and Truffer, 2014), it is argued that the nuclear industry has been close enough to the political elite that the two together can be considered one regime.

The main question to be addressed is why wind and solar energy could not yet take off (Rotmans et al., 2001). In other words, why could these technologies not leave the first "formative" or "predevelopment" phase of transitions (Rotmans et al., 2001; Wilson and Grubler, 2011), after which the innovation can be considered a serious competitor and there is a realistic chance of regime transformation (Geels et al., 2017)? Note that defining when exactly this happens is not easy (Genus and Coles, 2008) and might depend on the type of the transition pathway (Geels et al., 2016; Geels and Schot, 2007). However, for this study it is enough to illustrate that no breakthrough has happened so far. Using a recently suggested indicator, this is indicated by the fact that wind and solar have not yet reached a 2.5% share of maximum market potential (Bento and Wilson, 2016).

### 2.2. Methods

The empirical investigation has three parts: document analysis, interviews, and media analysis. The document analysis is based on publicly available technological and strategy documents. It covers key aspects of energy policy, such as supply and demand (Helm, 2002), costs and financial support for different energy sources (Fouquet and Johansson, 2008), the liberalization and integration of electricity markets (Verbong and Geels, 2007), the strength of lobbies and public support (Hughes and Urpelainen, 2015), and political factors (Meadowcroft, 2009). This part of the research provides context for the analysis.

Further insights are gained from 21 semi-structured interviews conducted with leading energy and electric power experts in 2016. The sample of informants is non-probabilistic. Interviewees are current and former leaders of the Hungarian transmission system operator (MAVIR), the dominant vertically integrated parastatal power company (MVM), the Hungarian power exchange, and the national energy regulator, senior representatives of power distribution companies, leaders of solar and wind industrial organizations, nuclear experts, former and current officials of different ministries and the President's Office[2], active politicians from the government party and the opposition, and leading academics from the most important energy research institutes. The sample represents all key organizations except for the government, and accounts for the diversity of expert opinions.[3] Interviews lasted for 45-120 minutes. They were not recorded because several questions were politically sensitive (see the questionnaire in Appendix A) and recording would have increased reluctance to discuss these topics. Instead, extensive notes were made. Data collected through the interviews help to identify explanatory mechanisms and drivers of policy decisions, as well as to map relations between stakeholders. Furthermore, personal discussions reveal preferences, perceptions and framings, and provide insight about scenarios considered possible and the ways of thinking that might have influenced energy policy making in the studied period.

In addition, more than 1500 relevant news articles from the popular media were analysed. The topics discussed in the chosen media source are considered a good reflection of the general public discourse. The news portal origo.hu was used for the analysis for three main reasons. First, it was the most popular, politically independent news source of the studied period[4] (mmonline, 2015, 2013), which had a much wider readership than print media and its coverage of energy issues did not differ substantially from other major online sources (Antal and Karhunmaa, 2018). Second, the site was launched in 1998, so the archives cover the entire focus period. Third, the database is searchable, freely available, and contains a sufficient number of articles for meaningful analysis. To find relevant articles, a number of search terms were used, which can be translated as solar energy, solar cell, solar power plant; wind

[2] The President is a figure head in Hungary. The political leader of the country is the prime minister.

[3] The official state opinion is not represented here. Potential respondents from the government did not answer my letters (e.g. the Secretary of State for Energy) or declined a full personal interview (e.g. the Renewable Energy Department of the Ministry of National Development). Due to the salience of the issue and the low level of trust, interviews are not granted on a regular basis. Nevertheless, interviewees generally agreed that the sample represents the opinions of electricity experts well. A complete list of names and affiliations is available upon reasonable request.

[4] In 2016 the website was sold and lost its political independence, now strongly favouring governmental views.

energy, wind power plant, wind turbine; renewable energy, renewable energies; and nuclear, atomic energy, reactor, nuclear power plant. Only the articles relevant for grid connected or building integrated power production were listed. For each article, title, date, countries mentioned, energy technologies, and topic codes were registered.[5] The analysis was done manually. The role of this section is to reveal how the studied technologies are represented in public discourse. The main focus is on the extent of coverage of different technologies and topics, as well as its changes over time.[6] For emerging technologies, media attention is considered as an indicator of success in the discursive struggle, even if world events largely influence which topics appear in the news (Bolsen, 2011). Although a quantitative study of media coverage yields limited understanding of what people know, discuss, and emphasize, it enables the identification of patterns that help or hinder the production of cultural legitimacy for different technologies. Moreover, the media can have direct influence on the views of decision makers, so attention to, or neglect of, given topics might explain certain political attitudes. The timing of political decisions with respect to public discussions can provide further insight into processes of decision making. In addition, I perform a narrowly focused content analysis of news articles on the project of nuclear expansion. I give an overview of the major steps in the process and collect cost estimates discussed at different points in time over the preparatory stages. This can help to assess the circumstances under which key policy decisions were made.

## 3. Renewable niches and the nuclear regime in Hungary (2000-2015)

### 3.1. Historical context and legacy infrastructure

To understand the context in which the electricity regime developed, two historical figures are useful. Fig. 1 shows electricity demand and supply broken down by sources in Hungary from 1964 to 2015. After the rapid growth of demand due to electrification, the collapse of socialism temporarily reduced electricity needs. A few years into the 1990s demand started to climb again at a more moderate, but still considerable, pace. The economic crisis of 2009 brought this to an end, and demand has been more or less flat after the crunch with some growth after 2014. In this last period, demand has typically fluctuated between 3500 MW and 6000 MW. Sectoral patterns of demand for 1995-2015 are shown in Fig. 2.

Generation, once almost entirely dominated by fossil fuels, has been diversified when four nuclear reactors started operation near Paks in the 1980s. The use of fossil fuels fell in the 1980s, but rose again in the 1990s, thereby reducing direct electricity imports. In the 10 years preceding the economic crisis, production from fossil fuels was relatively stable. After the crisis, production from imported gas and from fossils overall started to fall rapidly, being replaced by electricity imports and, to a smaller extent, renewables–mostly biomass.

Between 2000-2015, the most important power plant was the Paks 1 nuclear power plant (NPP) with 2000 MW capacity (upgraded from 1760 MW) and more than 7000 hours of annual operation (MAVIR, 2016b). The lifetime of all four reactors is expected to be 50 years, working until the 2030s. The second most important plant was the 920 MW Mátra power plant, which uses domestic lignite and ran more than 6000 hours annually in most years. Its retirement is scheduled for the 2020s (MAVIR, 2016b). All other power plants–most of them gas- or biomass-fired–are either much smaller (below 250 MW) or have not been used for more than 2500 hours per year throughout the whole period. In 2015, the two largest plants accounted for 72% of domestic generation (MAVIR, 2016b).

Besides technological aspects, the international institutional landscape was important for Hungary, which joined the EU in 2004 after a long accession process. Since the 1990s the formal aim of EU directives has been to create a common and free electricity market.[7] This requires unbundling, i.e. independent managements for power suppliers and grid operators, independent regulators who enforce market rules, cross-border cooperation, and open retail markets (European Commission, 2016a). The official goal has been to prevent/correct market distortions, solve technological compatibility issues, help the convergence of regulations, and increase access to information needed in a unified market. The process has been coordinated by the association of European electricity transmission system operators (TSOs) called ENTSO-E, which has legal mandates from the EU. While most experts support integration, it is also clear that various interest groups try to influence concrete technological, economic and regulatory decisions. Explicit and implicit subsidies, persistent transmission bottlenecks, uncoordinated policies, and actors that compete simultaneously in several different markets (e.g. electricity and heat) cause distortions (Glachant and Ruester, 2014). Nevertheless, disintegration is widely seen too costly, so the imperfect process of integration will likely continue.

### 3.2. A stable technological regime (2000-2002)

In 2000 when the present analysis begins, there was a centre-right Fidesz government (in power since 1998). The process of liberalization in the energy sector had started a few years earlier and the country, preparing for the EU accession, had chosen a market-based, Anglo-Saxon model of reform (Von Hirschhausen and Waelde, 2001). Vertically integrated monopolies had to be broken up, several power plants and utility companies were sold, but MVM (the largest energy company that owns the NPP) and MAVIR (the Hungarian TSO) were not privatized (Kádár, 2017). On the supply side, the technological regime was stable and

[5] For Hungarian search terms and topic categories see Appendix B.
[6] Studying specific interpretations of stakeholders is beyond the scope of the analysis.
[7] Notwithstanding that certain conditions for the efficiency of free markets are not met in the case of electricity, e.g. there are barriers to market entry on the supply side.

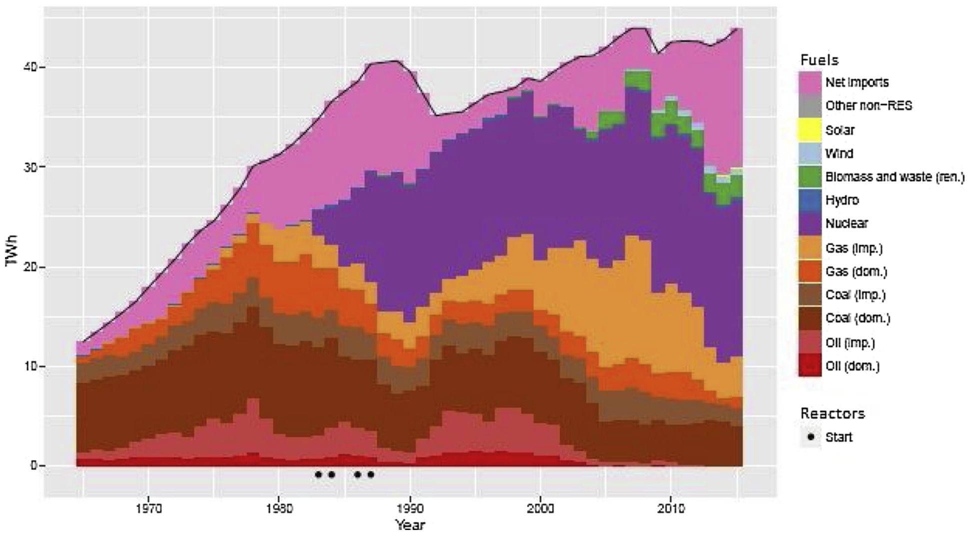


**Fig. 1.** Electricity consumption and production by sources in Hungary (gross), 1964-2015 (IEA, 2017a).

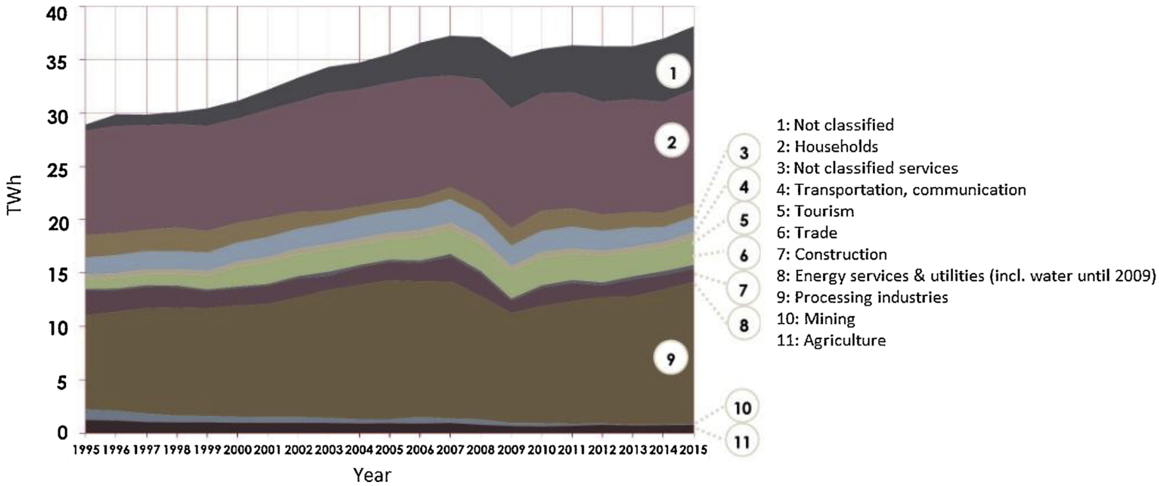


**Fig. 2.** Electricity consumption by sectors in Hungary (net), 1995-2015 (MAVIR, 2016a).

electricity was not a very important political topic. Wind and solar development has only started in a few early-adopter countries, none of which were in the CEE region. Nuclear, on the other hand, looked cheap[8] and reliable.

### *3.3. Emerging renewables, steps towards nuclear expansion (2002-2010)*

From 2002 to 2010, first a socialist-liberal coalition (2002-2008) then a minority socialist government (2008-2010) was in power. Liberalization in the energy sector continued. In 2003, a free electricity market was set up where producers could sell and large industrial consumers could buy electricity. Five years later all consumers got access to the free market, even though the smallest consumers retained the right to buy electricity at prices set by the regulator. This was important because at purchasing power parity (PPP) prices were the highest within the EU (2007 data from Bouzarovski and Tirado Herrero, 2017). Electricity trading and grid operation were separated, which led to the entrance of an increasing number of electricity traders. Market actors also invested in new gas-fired supply. Around 1000 MW generation capacity was finished in 2009-2010. These plants were then mostly idle in subsequent years because demand stagnated and gas became less competitive.

The emergence of renewables was facilitated by a feed-in tariff (FIT) from 2003, which provided similar compensation for wind, solar and (until 2011) co-generation plants (Fodor, 2012). Subsidies were financed from a tax on industrial power consumption from

[8] Partly because construction costs were already written off and waste management and decommission costs were not collected at a sufficient rate (European Commission, 2016b).

which households were exempt.[9] The average FIT rate exceeded estimated wholesale prices by 30-70% before the economic crisis and by 100-200% afterwards as electricity prices fell (Kaderják, 2011). As a result of the FIT, several coal-fired power plants switched fuels–at least partly–to biomass, so renewable electricity generation started to grow (Fig. 1, Fig. 3). In the wind sector, development began with the first national tender in 2006, which had an upper limit of 330 MW.[10] The subsequent process was heavily criticized because people close to the socialist government were awarded permits, which they later sold to real investors. A ministry department leader described the auction of a previously untapped resource as a “perfect crime”.

Meanwhile, in view of consistently inflated demand projections (MAVIR, 2016a) and the ageing fleet of power plants, an older generation of engineers who were in senior positions in MAVIR, MVM and the academic sector, called for state investment in traditional energy sources. One year after a serious incident at the Paks 1 NPP in 2004, the lifetime extension of existing nuclear reactors began, despite opposition from the most vocal anti-nuclear, pro-renewable NGO called *Energiaklub*.[11] In 2007, a secret preparatory study of a new NPP (Paks 2) was launched (Kovács, 2009). By 2008, an energy strategy document was developed, which proposed both new nuclear and a significant development of renewable electricity, but this never became official energy strategy. In 2009, in the midst of the economic crisis and days before the scandal-ridden prime minister resigned, the parliament approved the strategic decision to build new nuclear reactors in Paks. Support was almost unanimous, even though only a few MPs have previously seen the results of the preparatory study and most of them had no information on possible technologies and the price (then estimated at € 5.1-5.9 billion).

### *3.4. Renewables on hold, contract on nuclear expansion (2010-2015)*

In 2010, Fidesz regained power with a 2/3 majority in the parliament with an increasingly far-right agenda, and stayed in power beyond the studied period. Under the new government important processes of liberalization and market integration continued. The Hungarian Power Exchange was set up in 2010, day-ahead electricity markets of Hungary, Slovakia and the Czech Republic have been coupled in 2012, and Romania joined in 2014. This led to a convergence of regional electricity prices (European Commission, 2015). In 2015, there were around 50 electricity traders and more than 70% of electric energy was traded under market conditions. Nevertheless, the government had two other goals that were less in line with the market-based approach: to re-nationalize part of the energy sector and to reduce utility costs for households. The former happened through the acquisition of gas infrastructure, the purchase of shares in key energy companies, and steps towards the buy-out of power distribution companies. The latter was done through direct price regulation[12] and was made one of the main campaign issues in 2014, to be kept on the political communication agenda afterwards.[13]

An official energy strategy was published in 2012 (NFM, 2012), but the action plans that would have had to translate the strategy into concrete steps were developed very slowly, and were not systematically followed through. The role of the ministry responsible for energy shifted towards the execution of ad-hoc decisions driven by short-term political interests. MAVIR, MVM and the energy regulator all saw their influence reduced, while the prime minister and his inner circle–unknown to all top energy experts interviewed–made most strategic decisions with little consultation. While several experts suspect that certain domestic and foreign interest groups had access to the prime minister, they generally do not know how crucial decisions were made. An extremely diverse group of experts feels that more open and structured discussions would be useful.

While most professionals were not sure whether the government had a longer-term strategy in the power sector, the contrast between its approach towards renewables and nuclear energy was perceptible. Right after the elections in 2010, a new wind tender for an additional 410 MW capacity was cancelled in its final stage despite applications for more than 1100 MW. Note that some applicants opted out of the guaranteed price system, i.e. would have been ready to compete without subsidies. No new tender was issued afterwards, leaving total wind capacity capped at 330 MW and the share of wind energy in domestic generation around 2%. Later, ignoring the objection of the President, the parliament approved modifications of the Electric Energy Act to effectively ban new installations. The arguments used to justify this, such as “wind mostly blows during the night and when demand is low” (Index, 2016), are false (as shown in Appendix C).

Solar energy, on the other hand, has only started to grow after 2010 and it was still below 10% of wind and 0.2% of total domestic power production in 2014 (Eurostat, 2017; MAVIR, 2016b). Although guaranteed prices have typically been 2-3 times higher than wholesale market prices[14] in this period, the government created uncertainty by first announcing a revision of the support scheme in 2011, then postponing it for six years. This directly contradicted a key aim of the official action plan on renewables, namely a predictable business environment (NFM, 2011). Difficulties of permitting also hindered progress. Note that in the early 2010s, solar support schemes in the Czech Republic and Bulgaria proved to be too costly, thereby becoming cautionary examples. However,

[9] This is the opposite of the German solution. Note that the share of income spent on energy is approximately twice as high in Hungary as in Germany, even though prices are much lower. Household power prices were around 40% of those in Germany in 2016 (MEKH, 2016a).

[10] As an academic who had an insider's view of the decision explained, the cap was entirely ad-hoc.

[11] The group emphasized the risks of nuclear more than the risks of sources that kill more people, such as coal, gas, and even biomass (Markandya and Wilkinson, 2007).

[12] This reduced PPP power prices to the European average and gas prices below that (MEKH, 2015). An alternative approach would have been to increase energy efficiency, which could have simultaneously reduced carbon emissions and energy dependence.

[13] Utility cost reduction is the signature policy of the Fidesz government, but earlier socialist governments also campaigned with promises to keep energy prices low. These promises were broken.

[14] As another comparison: guaranteed prices were approximately 75% of household electricity prices in 2014.

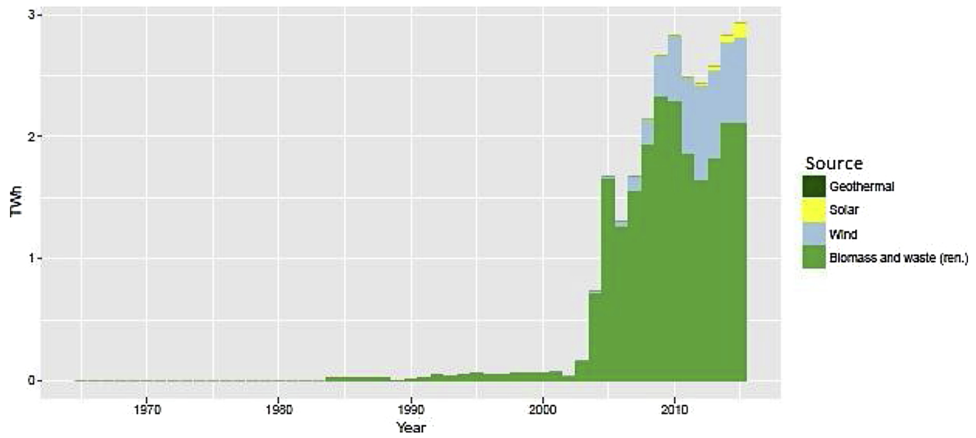


**Fig. 3.** Renewable electricity production in Hungary, 1964-2015 (IEA, 2017b).

between 2010 and 2014 PV costs fell by around 75%, and solar entered the cost range of fossil power (IRENA, 2015, Fig. 5.2, 5.10, and E.S.3). Globally, renewables took off, attracting most new investment (REN21, 2017). In 2015, installed PV capacity in Hungary almost doubled and surpassed 150 MW due to two utility-scale projects (16 + 10 MW) and acceleration in both the commercial and the residential sector (MEKH, 2016b). In the same year, the government imposed a hazardous waste tax on PV panels, which increased costs by a few percent and aggravated uncertainty. The tax was condemned by the opposition, especially the tiny green party, and the President who mistakenly signed it as part of a larger package (KEH, 2015). According to government communications, solar might play a somewhat larger role in the future, which might help to achieve the 2020 renewable energy targets that were submitted to the EU (14.65% share of renewables in gross final energy consumption). Nevertheless, at the end of the studied period Hungarian per capita electricity generation from intermittent renewables was one of the lowest among all member states (Table 1).

Regarding nuclear energy, there was a period of uncertainty after the news of the 2011 Fukushima disaster and the German nuclear exit. A few years later most stakeholders expected that the Paks 2 process will proceed with an international tender. Even nuclear experts were surprised in January 2014, when the prime minister announced a contract with Russian Rosatom to buy an NPP

**Table 1**
Per capita electricity generation from wind and solar energy (combined) in the EU, 2000-2015 [MJ/person/year]. (Source: Eurostat, 2017 Net electricity generation for wind and solar energy, including main activity producers and autoproducer electricity. Population estimates given in Appendix D refer to the end of 2015.).

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Belgium | 5 | 12 | 18 | 28 | 46 | 72 | 116 | 157 | 215 | 368 | 590 | 1104 | 1549 | 1989 | 2371 | 2729 |
| Bulgaria | 0 | 0 | 0 | 0 | 1 | 3 | 10 | 24 | 61 | 120 | 349 | 482 | 1020 | 1370 | 1294 | 1420 |
| Czech Rep. | 0 | 0 | 1 | 2 | 3 | 7 | 17 | 43 | 88 | 128 | 324 | 876 | 869 | 851 | 879 | 959 |
| Denmark | 2692 | 2733 | 3096 | 3530 | 4179 | 4198 | 3877 | 4552 | 4398 | 4268 | 4959 | 6212 | 6583 | 7387 | 8678 | 9352 |
| Germany | 417 | 468 | 711 | 840 | 1151 | 1259 | 1455 | 1890 | 1987 | 1998 | 2188 | 3027 | 3406 | 3657 | 4130 | 5209 |
| Estonia | 0 | 0 | 3 | 17 | 22 | 148 | 208 | 249 | 364 | 534 | 759 | 1008 | 1189 | 1448 | 1653 | 1957 |
| Ireland | 190 | 260 | 302 | 353 | 509 | 865 | 1261 | 1522 | 1874 | 2298 | 2189 | 3406 | 3119 | 3532 | 3997 | 5112 |
| Greece | 150 | 253 | 218 | 341 | 374 | 423 | 568 | 606 | 751 | 865 | 960 | 1312 | 1562 | 2603 | 2501 | 2849 |
| Spain | 367 | 522 | 721 | 937 | 1211 | 1645 | 1800 | 2157 | 2695 | 3358 | 3909 | 3970 | 4653 | 5229 | 4987 | 4776 |
| France | 3 | 7 | 15 | 21 | 33 | 53 | 119 | 222 | 311 | 438 | 573 | 766 | 1026 | 1075 | 1255 | 1545 |
| Croatia | 0 | 0 | 0 | 0 | 2 | 9 | 16 | 30 | 34 | 46 | 118 | 171 | 281 | 447 | 648 | 722 |
| Italy | 34 | 71 | 84 | 87 | 111 | 140 | 177 | 240 | 298 | 423 | 645 | 1207 | 1888 | 2128 | 2181 | 2202 |
| Cyprus | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 9 | 13 | 17 | 153 | 517 | 850 | 1143 | 1092 | 1426 |
| Latvia | 7 | 6 | 20 | 87 | 89 | 85 | 84 | 94 | 107 | 89 | 89 | 127 | 206 | 216 | 253 | 266 |
| Lithuania | 0 | 0 | 0 | 0 | 1 | 2 | 17 | 131 | 162 | 194 | 276 | 586 | 668 | 799 | 879 | 1089 |
| Luxembourg | 158 | 151 | 151 | 172 | 302 | 442 | 500 | 537 | 512 | 525 | 481 | 568 | 726 | 991 | 1105 | 1300 |
| Hungary | 0 | 0 | 0 | 1 | 2 | 4 | 15 | 40 | 74 | 119 | 192 | 224 | 276 | 263 | 252 | 290 |
| Malta | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 42 | 144 | 245 | 576 | 788 |
| Netherlands | 178 | 178 | 205 | 286 | 405 | 447 | 589 | 739 | 914 | 984 | 861 | 1107 | 1107 | 1300 | 1399 | 1844 |
| Austria | 29 | 46 | 62 | 162 | 398 | 538 | 714 | 835 | 825 | 805 | 862 | 841 | 1121 | 1483 | 1850 | 2277 |
| Poland | 0 | 1 | 6 | 12 | 13 | 13 | 24 | 49 | 78 | 101 | 156 | 298 | 440 | 556 | 709 | 1009 |
| Portugal | 59 | 89 | 126 | 173 | 284 | 615 | 1019 | 1410 | 2014 | 2690 | 3251 | 3276 | 3683 | 4321 | 4402 | 4286 |
| Romania | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 56 | 252 | 481 | 897 | 1400 | 1630 |
| Slovenia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 23 | 113 | 282 | 382 | 455 | 489 |
| Slovakia | 0 | 0 | 0 | 1 | 4 | 4 | 4 | 5 | 5 | 4 | 15 | 267 | 285 | 394 | 400 | 340 |
| Finland | 52 | 47 | 43 | 62 | 80 | 114 | 103 | 126 | 174 | 185 | 197 | 320 | 329 | 513 | 733 | 1537 |
| Sweden | 168 | 177 | 224 | 250 | 312 | 344 | 363 | 526 | 733 | 914 | 1287 | 2233 | 2634 | 3622 | 4137 | 6001 |
| United Kingdom | 52 | 53 | 70 | 71 | 107 | 161 | 234 | 292 | 395 | 515 | 570 | 879 | 1172 | 1682 | 1992 | 2648 |

of 2 × 1200 MW for € 12.5 bln. The reactors were expected to be built until the mid-2020s and to run for 60 years. Some experts worried that sufficiently detailed specifications might have been missing due to the absence of a tender. Considering the uncertain availability of financing, the effects of a potential nuclear accident happening anywhere, or world political events and the history of Russian blackmailing with energy projects, it was clear from the outset that the project is risky. Whether professional conditions of construction will be given without significant delays also looked uncertain. Both expert opinions, including those of supporters of the project, and international examples suggested that cost escalation was virtually guaranteed (Gilbert et al., 2017). Costs not covered by the contract, such as grid development, reserve capacities, and cooling towers, added to these concerns. Modelling results showed that even at the contract price the business case for a new NPP was very questionable (Felsmann, 2015).[15]

If the new NPP is built, then a key question is how long Paks 1 and Paks 2 will operate simultaneously. During the overlap, originally planned to be 6-7 years (2026-2032), nuclear capacity would be 4400 MW. Without fast growth of night-time consumption or storage, this would mean forced exports almost every night or lower capacity utilization (and lower revenues) than officially planned. A related question is whether grid development, cooling towers and other additional investments only needed for the period of the overlap will be realized or not. If yes, then the costs of these should be considered. If not, because this is just a safety period to buffer against expected delays, then revenue flows will likely start later and the financial viability of the project will be further compromised.

After the deal was struck, the nuclear regime intensified its activities to justify the decision and discredit potential competitors, especially renewable sources. Publicly visible efforts included a website paid by Rosatom (atomenergia.info) and the blog of the leader of the Paks 2 project (aszodiattila.blog.hu). These pages portrayed alternative scenarios, such as the anti-nuclear and pro-renewable path of Germany, as a failure, sometimes using misleading interpretations (Antal and Karhunmaa, 2018). The latter page also spread bizarre misinformation on solar (Aszódi, 2016). Simultaneously, *Energiaklub*, which called for an alternative pathway, was one of the subjects of a surprise raid by the Governmental Control Office (and later another by the National Tax and Customs Administration), which was highly publicized in the media. The intimidating process was ordered by the prime minister, but did not find anything unlawful. Nevertheless, criticizing the nuclear deal or advocating renewables looked increasingly risky.

## 4. Renewable niches and the nuclear regime in the media (2000-2015)

Fig. 4 shows the number of articles published on each technology per year. Three characteristics are observed. First, nuclear energy was by far more discussed than others: altogether there were 1106 nuclear articles as opposed to 429 on the other technologies combined. Approximately half of all nuclear news were about incidents and accidents, their implications, protests, and safety issues. Second, solar energy got significantly more attention (202 articles) than wind (85 articles), even though wind provided significantly more electricity both locally and globally. This is especially surprising for the middle of the period when relative differences were large. Third, trends for the studied technologies were different: there were very large fluctuations for nuclear, slow growth for solar, and decline from a tiny peak for wind.

Separating news on international and domestic issues provides further insights. Fig. 5 shows attention to international topics. The striking feature is not the Fukushima peak (more than 40% of international nuclear articles were on Fukushima or Chernobyl), but the slow growth of attention to intermittent renewables despite their global take-off. In 2010-2015, non-hydro renewable energy production grew 15.2% per year worldwide, rapidly catching up with nuclear production (GCP, 2016). In 2015, renewables led by wind and solar attracted more investment than all other energy technologies combined (IEA, 2016). This transformational shift got meagre attention. It is also notable that more than 50% of all wind and solar articles were about individual projects, firms, or technological innovations. Strategies, support schemes, or the overview of developments and systemic aspects were covered even less frequently.

Concentrating on domestic issues as in Fig. 6, one observation stands out. Discussions of important energy policy issues in the media follow, not precede, decisions. The local maxima for both wind and solar were reached in years when a negative policy decision triggered some responses: in 2010 after the cancelled wind tender and in 2015 after the PV tax. Even more telling is the case of the nuclear expansion. The Paks 2 contract was signed and announced on January 14, 2014. Before the decision, there was scant public attention to the issue. However, news of the contract triggered a wave of responses. Within two years, 130 articles were published on the topic, as opposed to 29 articles in all previous years combined.

The timeline of the Paks 2 decision as reconstructed from articles on origo.hu (Fig. 7) sheds further light on energy policy making in Hungary. One insight concerns the timing of decisions. In 2009, the parliament approved nuclear expansion just a few weeks after it was first publicly mentioned, without any discussion of the results of the secret preparatory studies (Origo, 2009). In 2014, the contract was entirely unexpected after repeated promises of an international tender (Origo, 2011a, 2012). The Hungarian Academy of Sciences organized a conference to discuss pros and cons of Paks 2 one month after the contract was signed (Origo, 2014).

Another insight concerns cost estimates. Besides speculative numbers put forward by journalists, government sources and opponents of the project estimated the price of a new NPP at different stages. In the 8 years preceding the 2014 decision, government cost estimates increased significantly. The preparatory study whose role was to serve as a foundation of the nuclear expansion

[15] Calculations by Felsmann (2015) have been published online. His result was that wholesale prices would have to increase by at least 50-75% to make Paks 2 economically commercial, which he deemed unlikely. A study commissioned by the government disputed certain assumptions and the results of this study, claiming that the project would be economically commercial without state aid (Rothschild, 2015). The European Commission concluded that financial support provided by the government to the project amounts to state aid, but greenlighted the project (European Commission, 2017).

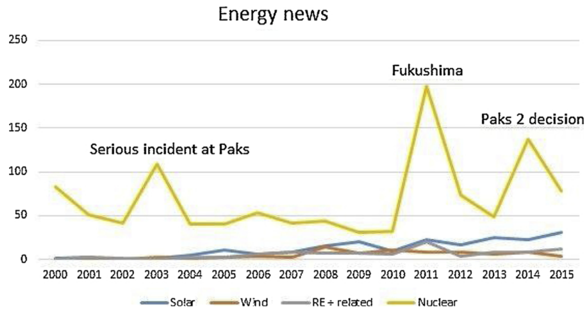


**Fig. 4.** The number of articles published by origo.hu on different energy sources per year, 2000-2015. "RE + related" refers to articles discussing different types of renewable energies including solar or wind, or broader energy questions with reference to solar or wind.

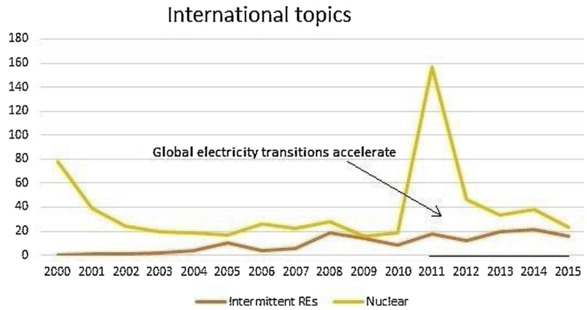


**Fig. 5.** The number of articles on international nuclear vs. solar + wind + renewable energy topics, 2000-2015.

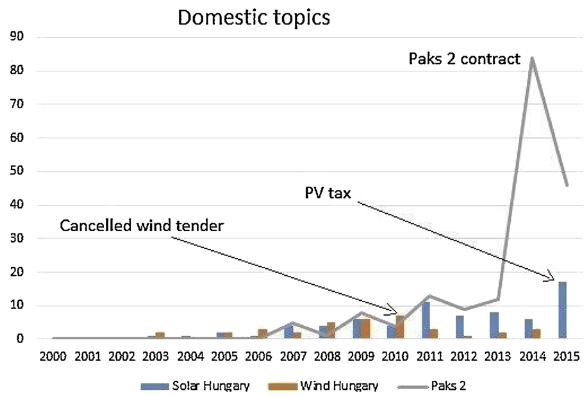


**Fig. 6.** The number of articles on the expansion of nuclear capacity (Paks 2), and domestic solar and wind issues.

estimated costs at less than 50% of the contracted value (Origo, 2009). The narrow range of € 5.1-5.9 bln might have created an impression of precision. This and other cost estimates by proponents of nuclear power appearing in the media could be misleading for decision makers, undeservedly increasing support. The real contract price, which was accurately predicted by an expert from *Energiaklub* in late 2011 (Origo, 2011b), could not be discussed by experts and the public as an actual offer because it was only made public after the decision. Beforehand, the uncertainty was extremely large (Fig. 7), which essentially ruled out informed discussions.

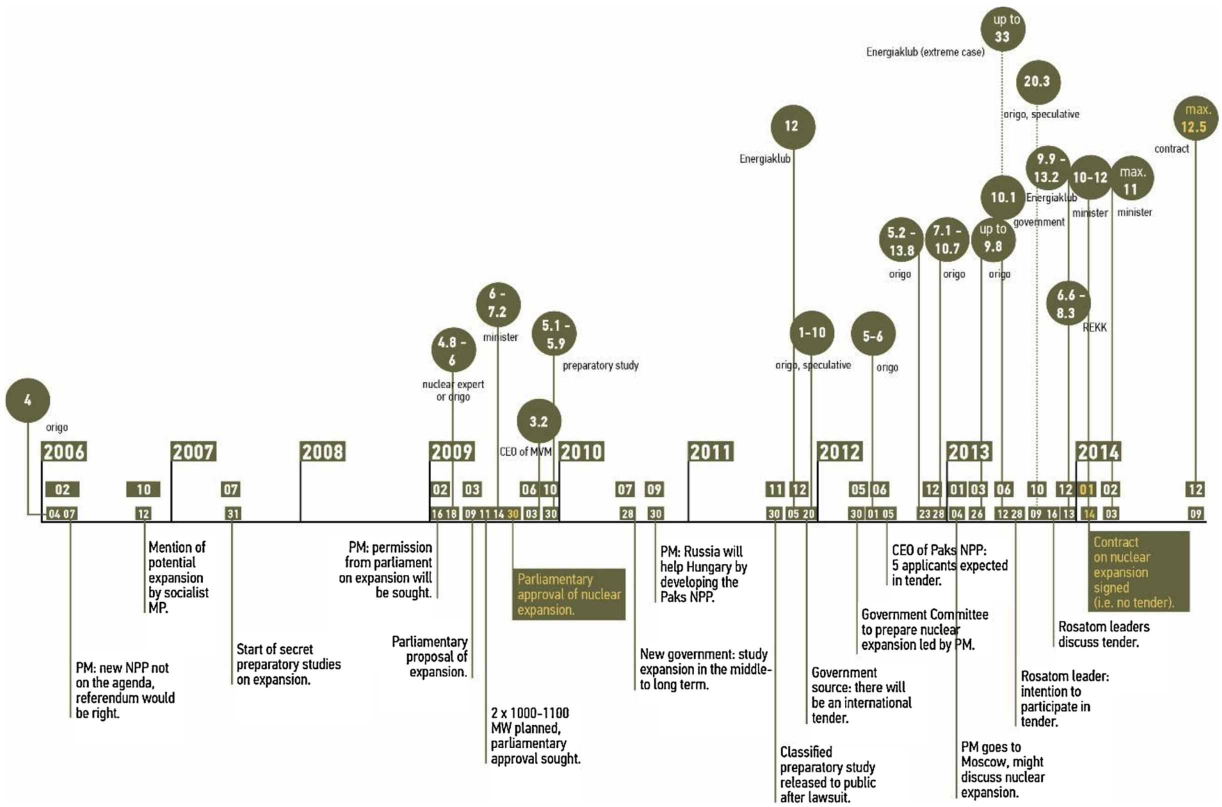


**Fig. 7.** Timeline of the decision to build a new NPP in Hungary. Years, months and days on which key articles on Paks 2 appeared on origo.hu are shown. Major steps are below the line, cost estimates–all that appeared on origo.hu–are above, in billion euros. Sources of cost estimates are indicated (REKK stands for the Regional Centre of Energy Policy Research). Costs were converted to euros at exchange rates valid when articles were published. If costs were given for capacities other than 2400 MW, linear conversion to 2400 MW was used (i.e. a fix €/MW value).

## 5. Discussion

### 5.1. General discussion

To analyse the role of niche-internal drivers and regime resistance in the limited development of wind and solar energy in Hungary, I first collect the main landscape-level factors–both slow developments and sudden changes or shocks–over the studied period. Then I argue that the nuclear industry has been close enough to all governments to consider them (the industry and the government at any point in time) as one regime. Subsequently, I discuss niche developments and regime behaviour, their actions and reactions, as well as their responses to landscape pressures and changes. Finally, I answer the main research question by looking at it from two angles–why the regime *could* prevent niche breakthrough (Section 5.2) and why the regime *wanted to* prevent niche breakthrough (Section 5.3)–and highlight the role of centralization in both the underlying processes and their analysis.

Five landscape-level factors are distinguished, which set the context for regime-niche interactions. First, the EU-driven liberalization of energy markets since the 1990s. Second, the climate and energy policy of the EU, including mandatory emission reduction and renewable energy targets after 2007. Third, the unexpected slowdown of demand growth due to the economic crisis after 2009. Fourth, the shock of the Fukushima disaster and its implications on European energy policy in 2011. Fifth, the unforeseen cost learning and global capacity growth of renewables, especially around the end of the studied period (Roberts, 2015).

I argue that regardless of the energy policy landscape, the nuclear industry has been part of the regime. In terms of domestic production, nuclear has been the most important source of electricity since the early 1990s. The industry directly employs 2500 workers at the NPP and a few hundred people at other nuclear facilities and in regulatory and R&D positions. Operating a written-off NPP is very good business, so–as a senior expert of a large energy company exaggeratedly put it referring to energy policy stakeholders–"everyone is paid by the NPP". For decades, there have been close personal connections between industry leaders and energy policy makers. While differences between the ideologies of the different governments were substantial, all of them were committed to the development of nuclear power. Parliamentary support for nuclear goals was almost unanimous. Furthermore, governments gave strategic advantages to nuclear, e.g. in the form of secret planning and the public intimidation of anti-nuclear groups. Therefore, even if their discursive strategies were sometimes different, I consider the nuclear industry and the government at any point in time as the regime in the electricity sector.

Notwithstanding the power of this regime, early development of the wind and solar niches in Hungary did not immediately suggest that the country will be a laggard in the EU in terms of intermittent renewable energy production. Before the 2009 economic crisis, generation was similar to that in other CEE countries[16] (Table 1). Wind development started, while in terms of costs the landscape was not yet favourable for the take-off of a solar revolution. For the longer term, a strategy based on nuclear and renewables looked feasible.

At the same time, there were several cautionary signs. Capacities for technology adoption through R&D, supply chain development, and alliances with key market players were not built up (Bento and Fontes, 2015). Partly because wind had low domestic added value and no base in installation jobs, the industry could not achieve a higher degree of institutionalization through strategic partnerships (Fuenfschilling and Truffer, 2014). Politically, the emerging wind business only had connections to the socialist government. There was negligible state-funded research or academic background for renewables, and the most vocal pro-renewable NGO (*Energiaklub)* employed only around 10 people. As it often happens in CEE countries, state–industry–science collaboration was inadequate (Ćetković and Buzogány, 2016).

Simultaneously, the nuclear regime was active. The preparation of the new NPP started very early, approximately 30 years before the existing one was scheduled to be closed. The industry used the right moment: demand was increasing (Fig. 1) and fossil fuel prices were rising (BP, 2016). New nuclear projects were started in Europe and a nuclear renaissance was discussed (Nuttall, 2004). The preparatory committee massively underestimated costs, swaying the long-term decision in their own favour. Besides providing such information to decision makers (Hillman and Hitt, 1999), the nuclear lobby used the same discursive strategies that have been observed in other regime-niche interactions (Smink et al., 2015), notably depicted renewables as not ready for the market at scale, very expensive, technologically disadvantageous in a rigid system, and not sustainable (e.g. arguing that balancing wind emits more $CO_2$ than gas). Despite liberalization, the political regime did not believe in a market-based approach to electricity supply and voted in favour of a centrally planned expansion of nuclear capacity (Reiche, 2006).

Actions and decisions of this early period got a new meaning for renewables after the landscape shocks and political changes starting around 2009. All of these shifted renewables from a tolerated niche into a potentially dangerous competitor of the regime. While the government wanted to achieve the renewable energy targets of the EU with minimal effort (e.g. with changes in accounting of biomass heating), the common climate policy meant that the longer-term future of fossil fuels became bleak, leaving renewables as the main alternative. Electricity demand growth stalled (Fig. 1), nuclear had to justify its existence after Fukushima, and cost estimates of a new NPP grew (Fig. 7). Realized and predicted cost learning of renewables indicated that power systems might fundamentally change within the lifetime of a new power plant or even the construction period of a NPP. Around the end of the studied period, usually both wind and solar required smaller subsidies than nuclear in European countries, shifting investments accordingly. In a short-term market sense, nuclear expansion became unreasonable.[17] Investing in renewables and putting the nuclear project on hold[18] looked more rational than proceeding with nuclear expansion. For the first time it became realistic to imagine scenarios fully based on renewables, even if international examples such as the German path (Morris and Jungjohann, 2016) looked expensive and uncertain (Antal and Karhunmaa, 2018) and the scale of the challenge was daunting.[19]

The multi-dimensional struggle between old and new technologies could have intensified, but the regime prevented this by policy means. Wind was banned by the new government. Subsidies for renewables were made uncertain, which reduced planning security and increased capital costs (Noothout et al., 2016). Solar was taxed when it became competitive, suggesting that the government can intervene in solar markets whenever it wants. On the other hand, the contract for Paks 2 was signed hastily. In the midst of an extremely volatile and uncertain period when heated discussions about the politics of energy re-emerged worldwide (Hughes and Lipscy, 2013), the Hungarian prime minister committed the country to nuclear energy for more than 70 years without open consultation with experts or the public.

[16] This is the right reference point because less innovation, weaker industrial policies and lower income generally delay technology adoption in more peripheral countries (Grübler, 1996).

[17] Regardless of total required capacity investments, it is not rational to start with nuclear which will need higher subsidies than wind and solar energy: even the study commissioned to support Paks 2 (Rothschild, 2015) talks about higher nuclear prices than could be rationally expected for renewables within a few years. The first German and UK auctions proved this in 2017 (Wirth, 2017). Whether the economics of renewables would change at higher levels of penetration was unknown.

[18] The nuclear contract has been classified, so the implications of any change are unknown.

[19] The German nuclear phase-out pales in comparison with the challenge of replacing Paks 1. This NPP satisfies around 37% of domestic power consumption, while the whole nuclear fleet in Germany satisfied around 22% in 2011. Closing one Paks 1 reactor is a larger change in relative terms (around 9%) than the famous post-Fukushima shutdown of 8 big reactors in Germany (6.4% (AGEB, 2016)). Furthermore, international climate commitments, which put no pressure on Hungary before (Reiche, 2006), made the closure of the second largest power plant in the 2020s increasingly likely.

### 5.2. Why could the regime hamper the development of renewables?

This subsection summarizes eight key aspects of regime stabilization in the face of landscape changes and niche developments. It shows how and why the regime could respond to external shocks and identifies various dimensions of control over niches. Subsequently, Table 2 attempts to distinguish the role of the regime level alliance between the government and supporters of the incumbent technology from the role of unique events and country-specific circumstances and the role of the illiberal turn. Note that any such distinction is bound to be imperfect since policy making has always been less transparent and inclusive in Hungary than in more established liberal democracies. Nevertheless, the illiberal turn has amplified several previously existing tendencies which contributed to regime stabilization.

*1) Early action by the regime*: The nuclear expansion was already in an advanced stage when the landscape changed, so a contract could be prepared when the future of the incumbent technology became uncertain. This was legally possible because of earlier parliamentary approval. By rushing towards the contract the regime could intentionally create techno-institutional lock-in (Unruh, 2000).

*2) Oblivious, reactive media*: The limited coverage of international energy transitions contributed to an awareness gap in the socially constructed landscape (Antal and Karhunmaa, 2018). Similarly, the meagre discussion of domestic developments limited the cultural legitimacy of wind energy. Furthermore, as processes of policy making are secretive, the media could only speculate–or could have no clue at all–about key decisions such as the wind ban, solar tax, or nuclear contract. Such a reactive media environment is characteristic of illiberal states due to centralized decision making, which means that discursive struggles over problem framings and social acceptance are different under these circumstances (Enyedi, 2016). Both the role of debates (justifying or challenging decisions that are already made) and how actor groups can participate in them (e.g. how they can prepare, plan their strategies, and access communication tools) differ from those in liberal democracies (Rosenbloom et al., 2016), strongly favouring the technologies supported by the government.

*3) Weak landscape pressure*: EU-level renewable energy targets for Hungary were not strong and could be achieved in part by changing accounting rules. The nuclear project was legally challenged in the EU because of the lack of an international tender and support through state aid, but the regime lobbied intensively in Brussels and expected its eventual approval (Szabó, 2017). Rhetorically, confrontation with the EU fit into the agenda of the illiberal government (Innes, 2015; Krekó and Enyedi, 2018). Although the project stretched the limits of a market-based approach to energy in the EU, it was finally permitted.

*4) Weak parliamentary opposition*: All major parties had personal connections to the nuclear industry, limiting parliamentary resistance to nuclear projects. After 2010, the socialist party collapsed, the liberal party vanished entirely, and the green party was weak. The government created a political system with a new election law, strong control over the media and unfair conditions for political competition as part of the illiberal turn, which secured a long-term, stable Fidesz majority, which could not be seriously challenged in any policy area (Bogaards, 2018).

*5) Weak pro-renewable lobbies*: The wind lobby lost all its political power after the change of government and disappeared almost entirely because its industrial base was negligible. The solar lobby was weak and fragmented. In 2015, the industry employed 1000-1500 people who worked for hundreds of companies, often only part time. Institutionalization was more difficult than in the case of more centralized sources, such as nuclear (Valentine, 2011). Therefore, renewable lobbies could not put much pressure on the government. Furthermore, in an illiberal system where decision makers are not known, niche players do not know who they could target with their messages.

*6) Weak pro-renewable experts*: Compared to the size of the country, a relatively large number of experts and researchers worked on nuclear energy at specialized research institutes, university departments, and regulatory bodies. Renewable energy had none of these. After 2010, high profile calls for policy support for renewables became increasingly risky, potentially affecting grant applications and job decisions (Kornai, 2015).

*7) Weak pro-renewable NGOs*: The fact that civil society is weak in post-socialist countries (Howard, 2002) is one reason for which pro-renewable groups could not change the discourse on energy. In an illiberal state, civil society groups can be intimidated (Zakaria, 1997). For instance, the government controlled media shows how leaders of such organizations are taken into custody, but not when they are released without charges. Intimidation can detract people from civil society and prevent the rise of new organizations working for renewable energy.

*8) No public outcry*: Awareness of the viability of renewables and views on normality could not change in the unsupportive media environment. Most Hungarians do not speak foreign languages, so diverse sources of information were less accessible to them. Furthermore, the acceptance of centralized decisions is higher in post-socialist countries than in older democracies. In an illiberal system the goal of politics is not to aggregate, but to change public preferences and to justify government decisions (Antal, 2017; Körösényi, 2005). As energy policy is complex[20], there is much room for framing (Munoz et al., 2014; Smink et al., 2015) and the government had very powerful tools for communication. Suggested economic benefits of utility cost reduction could be advertised on television, the print media, thousands of billboards, and each energy bill, even after directly set prices were above market prices. This strategy was effective due to high energy prices, the low willingness to pay for renewable energy (Teleszkóp, 2016), and the high level of control over the media in illiberal Hungary (Bajomi-Lázár, 2013).

[20] Consider the total costs of different energy strategies. It is difficult to properly quantify systemic costs for renewables (Bloomberg, 2016), budget overruns and implicit subsidies (e.g. project guarantees) for nuclear (Bradford, 2012; Gilbert et al., 2017), and rebound effects for the reduction of demand (Antal and van den Bergh, 2014; Sorrell and Dimitropoulos, 2008).

**Table 2**
Why could the regime react to landscape changes and keep control over niches? Explanations based on regime alliance between the government and supporters of the incumbent technology, country-specific circumstances and unique events, and the illiberal turn.

| | Role of regime alliance between government and incumbent industry | Role of unique events and country-specific circumstances | Role of illiberal turn |
|---|---|---|---|
| **Early action by the regime** | Government approval for early steps towards long-term energy policy decisions favouring incumbents | Fukushima disaster and global take-off of renewables shortly after parliamentary decision to expand nuclear and the illiberal turn | Key decision (on contract) potentially accelerated by increasing centralization and exclusion of experts when regime technology was threatened |
| **Oblivious, reactive media** | Incumbent technology helped by non-transparent decision making and supportive government communication | Cultural legitimacy of renewables weaker due to limited coverage of energy transitions in Hungarian media | Media in increasingly reactive position amid less and less transparent decision making, limiting discursive struggles |
| **Weak landscape pressure** | Key lobbyist with connections to suppliers of chosen technologies and decision makers in Brussels paid by the government | Nuclear technology supported by other member states and commissioner in the EU | Confrontation with EU not considered politically problematic: battles can be won, confrontational rhetoric useful |
| **Weak parliamentary opposition** | Personal connections between all major parties and supporters of incumbent technology | Collapse of the socialist and liberal parties in 2010 | Political system designed to strongly favour the government |
| **Weak pro-renewable lobbies** | Weak industrial base of renewable sources; institutionalization more difficult than for more centralized sources | Wind lobby more connected to socialist government, which lost power in 2010 | Non-insider lobby difficult due to increasingly non-transparent decision making |
| **Weak pro-renewable experts** | State funded research and education on nuclear energy much larger than on renewables | Relatively large number of nuclear experts due to the importance of a single NPP in a small country | High profile calls for renewables risky for grant applications and job decisions in public sector |
| **Weak pro-renewable NGOs** | Very limited support from the state for pro-renewable NGOs | Weak civil society in post-socialist countries | Intimidation of NGOs by the government |
| **No public outcry** | Unrealistic cost estimates used by government; few platforms offered for public debate; weaker voices ignored in decision making | Weak public participation in post-socialist countries; diverse sources of information less accessible due to language barrier | Public preferences shaped, not aggregated, by government through powerful propaganda |

### *5.3. What were the motivations of the regime?*

Collecting possible motivations gives another angle to the answer of the research question. Potential explanatory mechanisms have to give account of the trajectories of the three studied sources. First, that wind was likely the cheapest source of electricity and permitting new developments was a “perfect crime” (money could be made without making someone worse off), yet the government banned it. Second, that Hungary missed the increasingly global solar boom due to unsupportive policies, but the government suggested a greater role for solar in the future. Third, that the government signed a nuclear contract when the business case for it was very questionable. Possible explanatory mechanisms are grouped by emphasizing the role of the interests of the regime, the ideas of key actors, and two main institutional aspects. Table 3 then shows for each mechanism whether the government or the nuclear lobby has a role in it, and whether the mechanism has been suggested by interviewees or by the literature and my analysis.

*Interests of the regime:*

*1) Political interests of the government*: Utility cost reduction was an excellent campaign strategy, which was not seen as compatible with support for renewables when it was planned. Renewable subsidies would have directly increased energy bills of companies while subsidies to other sources could be hidden. This was key from a political marketing perspective. Price setting was presented as direct governmental assistance to people, and it was very effective from a communication perspective, which is key for any populist regime (Antal, 2017; Enyedi, 2016).

*2) Economic interests of the state*: The state owns large power plants whose utilization factors and profitability would have decreased due to high shares of renewables (Ondřich, 2016). The new NPP would not cause similar problems because most existing plants will be closed by the time it starts operation. Nevertheless, there might be an overlap between the operational periods of NPPs (Paks 1, Paks 2, even a potential third NPP).[21] If nuclear capacity is above night-time consumption, then developing wind energy can be problematic because night-time generation can exceed demand. As daytime consumption is higher, there are fewer reasons to restrict solar.

*3) Economic interests of the nuclear industry*: Advocates of nuclear energy saw renewables as a competitor and had a much stronger influence on policy decisions than renewable lobbies. Potentially falling capacity utilization of NPPs appeared as a risk for revenues, profitability, political influence, and the long-term survival of the industry. The international nuclear lobby had a role in speeding up the expansion process, e.g. by pressing a relatively small and weak state to not issue an international tender.

*4) Economic interests of individuals close to the government*: A large, complex, centralized project offers better opportunities for

[21] Since operating a written-off plant (Paks 1) is very good business, lifetime extensions beyond the 2030s might be considered. Note that safety considerations can make this impossible.

corruption than smaller, simpler, decentralized ones (Locatelli et al., 2017).[22] Due to increasingly centralized networks of corruption in Hungary (Fazekas and Tóth, 2016), Fidesz oligarchs will have a large role in domestic supply chains of the nuclear expansion (Szabó, 2018).

*Ideas of the regime:*

*5) On the scale of the challenge*: Given the aging fleet of power plants, key political decision makers and their industrial advisors did not believe that secure supply can be guaranteed by relying solely on market mechanisms, and they looked for a large-scale and tested solution.

*6) On how the economy should work*: Political decision makers took the interests of the nuclear industry as necessary for furthering the interests of 'capital-in-general' to create jobs, tax revenues and economic growth (Newell and Paterson, 1998). The same might have not been true for renewables because of their lower historical importance.

*7) On the economics of renewables*: Political decision makers did not realize how fast cost learning was and that certain investors in the wind sector would have been ready to compete without subsidies since 2010. Low awareness of global and regional changes was exacerbated by the exclusion of experts and the public from the preparation of decisions.

*8) On the economics of nuclear*: Advocates of nuclear energy realized that they can lose the price competition, so they pushed for rapid action while arguments for nuclear still looked reasonable. Cheap renewables like wind had to be blocked to maintain the image of nuclear being cheap. Anti-nuclear, pro-renewable activists had to be attacked not least because they gave realistic cost estimates for the new NPP (Fig. 7), threatening the legitimacy of the technology.

*9) On the importance of domestic supply chains*: The political part of the regime considered domestic added value and job creation in the energy sector very important. In this respect, wind energy was the worse because even installation and maintenance were mainly done by foreign companies. Solar was better because domestic firms could install and maintain the technology. This explains why politicians did not favour wind and had a somewhat more positive attitude towards solar. Hopes that domestic suppliers will have a relatively important role in the nuclear project were high.

*10) On renewables in general*: The prime minister personally disliked renewables, either because of aesthetic reasons (wind) or political perceptions, notably viewing climate change and renewables as "left-liberal" issues internationally and a "socialist" business in Hungary. Such political perceptions also explain Hungary's consistent opposition to strong European climate policy[23] (Hungary Today, 2018; Skjærseth, 2016; Skovgaard, 2014), which would otherwise make all low carbon power plants (including nuclear) more profitable and significantly increase national income from emission trading. The industrial part of the regime disliked renewables because pro-renewable NGOs had a track record of scientifically unfounded attacks against nuclear energy. The relationship became even more hostile as the industry tried to discredit renewables.

*11) On centralized vs. decentralized systems*: Increasing centralization has been the hallmark of the post-2010 period in Hungary (Bogaards, 2018; Enyedi, 2016). Strong governmental preference for remaining a central actor in the electricity system as opposed to energy democracy played a role.

*Institutional aspects:*

*12) Institutional stability until comfortable*: The government tried to comply with binding EU targets with minimal effort. The industry happily cooperated with the government until its interests were advanced. The institutional structure was comfortable for the regime, making any disruption undesirable.

*13) Institutional flexibility when profitable*: In illiberal systems, abrupt institutional changes are possible if short-term political or (private) economic interests dictate that.[24] The government adapted to landscape changes by temporarily blocking renewables, just to take over the niche industries when incumbents–or other actors chosen by leading politicians–are ready for the new technology (Smink et al., 2015). While erecting barriers to renewables, the government was already planning a solar boom in which people close to the prime minister were to have important roles (Átlátszó, 2018). Meanwhile, government communication reflected the planned policy change.

Motivations of the nuclear lobby were likely a mix of the above, all serving the relatively straightforward objective of maintaining their dominant position. Objectives of the government can be more complex. Which of the above motivations had any role and which were decisive is essentially unknown. Policy documents give no explanation, top electricity experts had no reliable information, and the media analysis revealed no clear motivation. In an illiberal state where the government has a central role, but official strategies are ignored, decisions are made in unknown circles, and official justifications of decisions are often false, it is not possible to go beyond speculation regarding causal mechanisms. Not fully understanding why things were happening as they were, interviewees could hardly guess about the domestic influence of innovation in the field of decentralized energy systems, let alone the future electricity mix.

[22] There are some indicative results showing effects of corruption on energy policies (Fredriksson et al., 2004). Fully revealing the strength of such effects is practically impossible. It is suspected that corruption is very important on the periphery of the EU (Martino, 2015; Tchalakov et al., 2011).

[23] Efforts by the regime to weaken European level climate and renewables policies show that the landscape is not always entirely out of reach for regimes. Longer-term changes can occasionally be influenced, so the regime-landscape distinction is not entirely clear, especially in multi-level governance systems.

[24] This is a main reason for which institutional constraints are not seen as decisive in the explanation of regime behaviour and no explanatory mechanisms are based on pressures that the regime had to respond to.

**Table 3**
The role of the government and the nuclear lobby in potential explanatory mechanisms of regime behaviour (as numbered above). The last column indicates whether the hypothesis has been put forward during the interviews or on the basis of the literature and analysis.

| | Government | Nuclear lobby | Source |
|---|---|---|---|
| **Interests** | 1,2,4 | 3 | 1,3,4: interviews<br>2: literature & analysis |
| **Ideas** | 5,6,7,9,10,11 | 5,8,10 | 5,7,9,10,11: interviews<br>6, 8: literature & analysis |
| **Institutions** | 12,13 | 12 | 12: interviews<br>13: literature & analysis |

## 6. Conclusions

The direct reason for which the breakthrough of wind and solar energy has not yet happened in Hungary is more or less clear: the government blocked niche development by policy means. Except for a short period after 2006, it was not legally permitted to develop wind energy, and when solar energy matured around the end of the studied period, its development was delayed by uncertainty created by the government around regulations, subsidies and taxes. The deeper, indirect reasons that explain why these strategies were both *feasible* and *desirable* for the regime are far more difficult to understand.

To study these questions, I used the MLP framework of sustainability transitions research. I argued that the nuclear lobby and the government at any point in time formed a relatively coherent regime between 2000 and 2015. I identified five landscape-level factors: European energy liberalization, European climate and renewable energy policy, the economic crisis and its impact on electricity demand, the Fukushima disaster, and the global take-off of renewables.

My first main objective was to explain how and why the regime *could* respond to both niche developments and these landscape pressures. The empirical contribution here is an overview and assessment of the multi-dimensional struggles between niche technologies and the existing regime (Geels, 2018) in the Hungarian context. Political decisions over general strategies and specific subsidies and taxes, the role of economic and business competition, and discursive struggles over the framing of energy policy issues and strategies were covered in the analysis. The theoretical contribution is the identification of how the illiberal turn–a change in the "general nature of the prevailing political, economic and legal systems" (Andrews-Speed, 2016) towards centralization and government control–affected renewables. Specifically, I studied how these effects changed the strength and nature of regime resistance.

Part of the explanation for why the development of renewables could be blocked is based on actions and characteristics of the regime alliance, as well as the role of unique events and country-specific circumstances. First, early actions by the regime to prepare a new NPP made it possible to sign the contract despite dramatic changes of the landscape. The success of nuclear energy meant difficulties for renewables because of enmities between the proponents of these technologies. This shows that the feasibility of scenarios in which both nuclear and renewables play important roles depends as much on socio-political conditions as on technological compatibility. Second, the media paid little attention to the global take-off of renewables, so the socially constructed landscape–especially discourses around costs–did not reflect actual international developments. Moreover, domestic energy decisions could not be discussed in their preparatory stages because of the secretive nature of policy making in Hungary. Third, EU targets on renewables were not strong and the new NPP was greenlighted despite state aid. As competition was between two low-carbon sources, longer-term climate targets put no pressure on decision makers. Note that the same targets affected fossil fuels negatively, making room for alternatives. Fourth, the parliamentary opposition and pro-renewable lobbies could not forcefully challenge any of the decisions. Unique political events such as the collapse of the socialist party in 2010 and difficulties of the institutionalization of decentralized renewables played important roles here. Finally, pro-renewable NGOs, experts, and the general public had very little influence on energy policy directions. The post-socialist heritage of weak civil society, the dominance of nuclear experts in a small country where a single NPP in itself is very important, low public awareness of alternatives, and weak participation were highlighted.

The illiberal turn aggravated most of these difficulties and moved some of them to new levels. The balance of power changed shortly after 2010 when the breakthrough of renewables could have become realistic. The new, illiberal government increased control over other actors and used its power to secure the future of the regime technology while blocking niches. Characteristics of the illiberal era include: (1) Rapid action when needed: facilitated by centralization and the increasing exclusion of experts. (2) Reactive media: policy decisions are preceded by even fewer discussions than before, so discursive struggles are biased towards the technology supported by the government. (3) Weaker role of landscape pressures: as confrontation with external powers is not avoided. (4) Weak parliamentary opposition: as the political system is designed to favour the government. (5) Difficult lobbying: as processes of decision making are largely unknown. (6) Experts threatened: as the independence of science is not respected. (7) Civil society intimidated: as crackdowns can be orchestrated by the government. (8) Public preferences shaped by propaganda: as government communication is highly coordinated but not necessarily based on facts. None of these are entirely unheard of in systems that are not called illiberal, but their simultaneous and forceful presence is characteristic of illiberalism.

The other main objective was to better understand why the regime *wanted* to block wind and solar. Which interests of the nuclear lobby or the government, ideas of the regime, or institutional factors might have been responsible for this? The answer for the industrial part of the regime is more or less clear: their main aspirations have likely been profitability and long-term dominance, also influenced by an ideologically hostile relationship with supporters of renewables. Motivations of the government are more difficult to reveal, especially in an illiberal system. As energy strategy documents are not followed, most experts are excluded from the policy process, pre-decision public discussions are missing, and post-decision justifications by the government are short and dubious, only speculation is possible. Suspected interest-based explanations include a perceived clash with political marketing strategies such as utility cost reduction, the potentially lower capacity utilization of state-owned power plants, and private interests that might profit most from large, centralized projects. Possible idea-based reasons include the disbelief in market-based approaches to energy supply, a preference to serve the interests of capital-in-general, low awareness of rapid global changes in electricity supply, attributing high importance to domestic supply chains, the personal aversion of the prime minister towards renewables, and preference for more centralized solutions as opposed to energy democracy. Institutions rarely constrained the actions of the illiberal government, but renewables could suffer due to the comfortable position of the regime that would have been disrupted by institutional changes or because the government put renewables on hold to let incumbents or others prepare for the takeover of these new markets. The diversity of these explanations reveals an analytical challenge that complicates the understanding of illiberal systems: while the balance of power is shifted towards the political regime in comparison with liberal democracies, explaining the motivations behind political decisions that drive or hamper change becomes increasingly difficult.

From a climate perspective, a nuclear phase-out in Hungary might still look risky. Nevertheless, rushing towards a new NPP was hasty and blocking the breakthrough of renewables put the country on a higher emission path than necessary. Both the socialist and the right wing government have responsibility in this, not least because both excluded experts and the public from key decisions. Before 2009, conditions that could have helped the spread of renewables–such as demand growth, ageing infrastructure, and growing imports–had a negative effect on wind and solar energy by triggering the project of nuclear expansion. After 2010, anti-renewables policies pushed the country to the bottom of renewable energy lists in Europe. Whether the future will be different will be decisive for a low-carbon, affordable and secure supply of electricity based on domestic sources, because such scenarios are difficult to imagine without a significant development of wind and solar energy.

**Acknowledgements**

I thank Áron Buzogány, Aleh Cherp, Frank Geels and Florian Kern for comments, Vadim Vinichenko for creating Fig. 1 and Fig. 3, János Vörös for Fig. 7, and all interviewees for their time and feedbacks on the draft. The research was supported by the National Research, Development and Innovation Office of Hungary under grant number OTKA-PD 116638.

**Appendix A. The questionnaire used for the interviews.**

1) What were the most important milestones and changes in Hungarian electricity policy since 2000?
2) Which actors and forums of decision making are most important for domestic electricity policy? To what extent do you know how strategic decisions are made (who is involved, what are decisions based on)? If it is possible to rank, please indicate whether technological, economic, political or ideological factors influence Hungarian electricity policy most!
3) What are the most important risks of wind and solar energy that slow down their deployment? Why did the government not issue a wind energy tender since 2010? Why did the government revise the support scheme for renewable energies in 2016, more than 5 years after first discussing this?
4) Are you sure that the Paks 2 NPP will be built? If not, what might stop it? What could be the reason for making the Paks 2 decision in 2014? What is the reason for the planned overlap between the operation of Paks 1 and Paks 2?
5) Do you think that the integration of European electricity systems is an irreversible process or countries might turn back to increase their independence? What could be a reasonably achievable electricity mix in 2030?

**Appendix B. Search terms and topic categories of the media analysis.**

List of Hungarian search terms: napenergia, napelem, napelemes, naperőmű; szélenergia, szélenergiás, szél energia, szélerőmű, szélturbina; megújuló energia, megújuló energiás, megújuló energiák; nukleáris, atomenergia, atomreaktor, reaktor, atomerőmű.

List of non-exclusive topic categories for renewables: “project” (reports on specific projects), “development” (how certain technologies spread in certain regions), “how to do” (practical advice), “strategy” (strategic alternatives or decisions), “support” (economic support schemes), “investment” (investment decisions), “finance/tender” (financial news and tenders), “firm” (news on individual firms), “technology” (mostly innovation), and “systemic/overview” (of given technologies or the whole energy sector). For nuclear energy: “strategy”, “waste”, “safety”, “disorder”, “protest”, “finance”, “firm”, “development”, “project”, “policy”, and “normal operation”. Articles dealing with the expansion of the Paks NPP were labeled P2.

## Appendix C. Wind energy profile, 2015.

Figs. C1–C2

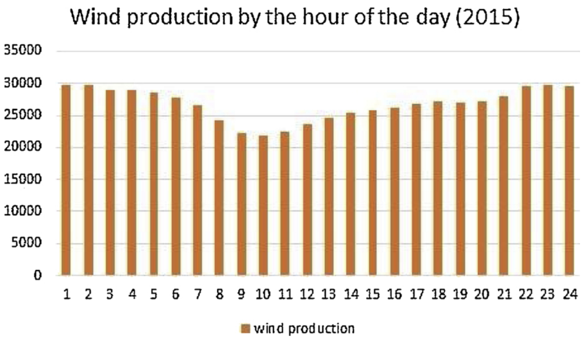


**Fig. C1.** Wind energy production by the hour of the day. Averages of hourly data from ENTSO-E. Differences are not big. Minimum production does not coincide with maximum use.

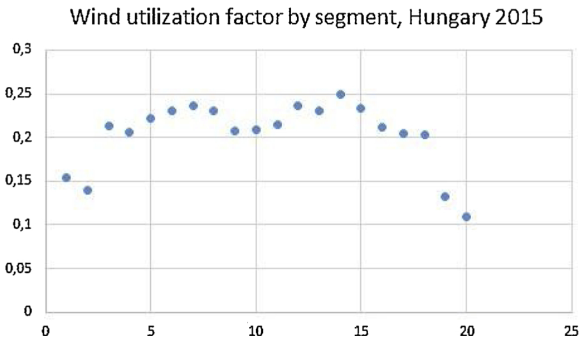


**Fig. C2.** Wind energy utilization factors by load segment, based on hourly data from ENTSO-E. The span between the yearly minimum and the maximum load was divided into 20 equal segments. In each segment there are hours from different days with similar consumption. The number of hours is different in the segments. Hours with the highest load are in the first segment, hours with the lowest consumption in the 20th. Average wind utilization is calculated for each segment. Had wind production been high in hours of low consumption, the curve would ascend. The actual curve shows that production is somewhat lower in the hours when consumption was very high or very low (there are few hours in these segments), otherwise it is fairly stable.

## Appendix D. Population estimates for EU countries (millions).

| Belgium | Bulgaria | Czech Rep. | Denmark | Germany | Estonia | Ireland |
|---|---|---|---|---|---|---|
| 11,3 | 7,2 | 10,5 | 5,7 | 81,3 | 1,3 | 4,6 |

| Greece | Spain | France | Croatia | Italy | Cyprus | Latvia |
|---|---|---|---|---|---|---|
| 10,8 | 46,3 | 66,4 | 4,2 | 61 | 0,9 | 2 |

| Lithuania | Luxembourg | Hungary | Malta | Netherlands | Austria | Poland |
|---|---|---|---|---|---|---|
| 2,9 | 0,6 | 9,8 | 0,4 | 16,9 | 8,6 | 38,5 |

| Portugal | Romania | Slovenia | Slovakia | Finland | Sweden | United Kingdom |
|---|---|---|---|---|---|---|
| 10,3 | 19,8 | 2,1 | 5,4 | 5,5 | 9,8 | 65,1 |

## References


AGEB, 2016. Bruttostromerzeugung in Deutschland ab 1990 nach Energieträgern (Gross power generation by energy source in Germany from 1990). AG Energiebilanzen e.V., Berlin.

Aguirre, M., Ibikunle, G., 2014. Determinants of renewable energy growth: A global sample analysis. Energy Policy 69, 374–384 https://doi.org/10.1016/j.enpol.2014.02.036.

Andrews-Speed, P., 2016. Applying institutional theory to the low-carbon energy transition. Energy Res. Soc. Sci. 13, 216–225 https://doi.org/10.1016/j.erss.2015.12011.

Antal, A., 2017. The Political Theories Preconditions and Dangers of the Governing Populism in Hungary. Politol. Časopis. Czech J. Polit. Sci. XXIV 5–20.

Antal, M., Karhunmaa, K., 2018. The German energy transition in the British, Finnish and Hungarian news media. Nat. Energy 3, 994–1001.

Antal, M., van den Bergh, J.C.J.M., 2014. Re-spending rebound: A macro-level assessment for OECD countries and emerging economies. Energy Policy 68, 585–590 https://doi.org/10.1016/j.enpol.2013.11.016.

Aszódi, A., 2016. Házi akkumulátorok és az "önellátó" napelemes lakóházak mítosza (Household batteries and the myth of self-sufficient solar homes). Láncreakció. URL aszodiattila.blog.hu/2016/10/24/hazi_akkumulatorok_avagy_az_onellato_napelemes_lakohazak_mitosza (accessed 2.14.17).

Átlátszó, 2018. Adnan Polat's son, Kerim, Gets Key Roles in His Father's Solar Panel Business in Hungary. 2018.10.12. URL: https://english.atlatszo.hu/2018/10/12/adnan-polats-son-kerim-gets-key-roles-in-his-fathers-solar-panel-business-in-hungary/.

Avelino, F., Rotmans, J., 2009. Power in Transition: An Interdisciplinary Framework to Study Power in Relation to Structural Change. Eur. J. Soc. Theory 12, 543–569 https://doi.org/10.1177/1368431009349830.

Bajomi-Lázár, P., 2013. The Party Colonisation of the Media: The Case of Hungary. East Eur. Polit. Soc. 27, 69–89 https://doi.org/10.1177/0888325412465085.

Batory, A., 2010. Post-accession malaise? EU conditionality, domestic politics and anti-corruption policy in Hungary. Glob. Crime 11, 164–177 https://doi.org/10.1080/17440571003669183.

Bento, N., Fontes, M., 2015. Spatial diffusion and the formation of a technological innovation system in the receiving country: The case of wind energy in Portugal. Environ. Innov. Soc. Transit. 15, 158–179 https://doi.org/10.1016/j.eist.2014.10.003.

Bento, N., Wilson, C., 2016. Measuring the duration of formative phases for energy technologies. Environ. Innov. Soc. Transit. 21, 95–112 https://doi.org/10.1016/j.eist.2016.04.004.

Bloomberg, 2016. New Energy Outlook 2016.

Blyth, M., 2003. Structures Do Not Come with an Instruction Sheet: Interests. Ideas, and Progress in Political Science. Perspect. Polit. 1 https://doi.org/10.1017/S1537592703000471.

BNEF, 2016. Mapping the Gap: The Road from Paris. Bloomberg New Energy Finance.

Bogaards, M., 2018. De-democratization in Hungary: diffusely defective democracy. Democratization 25, 1481–1499 https://doi.org/10.1080/13510347.2018.1485015.

Bolsen, T., 2011. The Construction of News: Energy Crises. Advocacy Messages, and Frames toward Conservation. Int. J. Press. 16, 143–162 https://doi.org/10.1177/1940161210392782.

Bouzarovski, S., Tirado Herrero, S., 2017. The energy divide: Integrating energy transitions, regional inequalities and poverty trends in the European Union. Eur. Urban Reg. Stud. 24, 69–86 https://doi.org/10.1177/0969776415596449.

Bozóki, A., Hegedűs, D., 2018. An externally constrained hybrid regime: Hungary in the European Union. Democratization 25, 1173–1189 https://doi.org/10.1080/13510347.2018.1455664.

BP, 2016. Fossil fuel price index [WWW Document]. Our World Data. URL https://ourworldindata.org/grapher/fossil-fuel-price-index. (accessed 9.6.17).

Bradford, P., 2012. Energy policy: The nuclear landscape. Nature 483, 151–152.

Brulle, R.J., 2014. Institutionalizing delay: foundation funding and the creation of U.S. climate change counter-movement organizations. Clim. Change 122, 681–694 https://doi.org/10.1007/s10584-013-1018-7.

Ćetković, S., Buzogány, A., 2016. Varieties of capitalism and clean energy transitions in the European Union: When renewable energy hits different economic logics. Clim. Policy 16, 642–657 https://doi.org/10.1080/14693062.2015.1135778.

Cho, C.H., Patten, D.M., Roberts, R.W., 2006. Corporate Political Strategy:An Examination of the Relation between Political Expenditures. Environmental Performance, and Environmental Disclosure. J. Bus. Ethics 67, 139–154 https://doi.org/10.1007/s10551-006-9019-3.

Clack, C.T.M., Qvist, S.A., Apt, J., Bazilian, M., Brandt, A.R., Caldeira, K., Davis, S.J., Diakov, V., Handschy, M.A., Hines, P.D.H., Jaramillo, P., Kammen, D.M., Long, J.C.S., Morgan, M.G., Reed, A., Sivaram, V., Sweeney, J., Tynan, G.R., Victor, D.G., Weyant, J.P., Whitacre, J.F., 2017. Evaluation of a proposal for reliable low-cost grid power with 100% wind, water, and solar. Proc. Natl. Acad. Sci. 201610381 114 (26), 6722–6727 https://doi.org/10.1073/pnas.1610381114.

Csoma, T., 2017. Az energiatermelő közösségek jelene és jövője Magyarországon (The present and future of community energy in Hungary) (Master's thesis). Loránd Eötvös University, Budapest.

Darvas, Z., 2008. The rise and fall of Hungary. The Guardian. 29 October, URL: https://www.theguardian.com/business/blog/2008/oct/29/hungary-imf.

Dawson, J., Hanley, S., 2016. The Fading Mirage of the "Liberal Consensus." J. Democr. 27, 20–34 https://doi.org/10.1353/jod.2016.0015.

ECF, 2010. Roadmap 2050: A practical guide to a prosperous, low carbon future. European Climate Foundation, The Hague, The Netherlands.

EEA, 2009. Europe's onshore and offshore wind energy potential (No. Technical report No 6/2009). European Environment Agency.

EIA, 2015. Electric generator capacity factors vary widely across the world [WWW Document]. Today Energy. URL https://www.eia.gov/todayinenergy/detail.php?.id = 22832# (accessed 2.13.17).

Eikeland, P.O., Sæverud, I.A., 2007. Market Diffusion of New Renewable Energy in Europe: Explaining Front-Runner and Laggard Positions. Energy Environ. 18, 13–36 https://doi.org/10.1260/095830507780157276.

Enyedi, Z., 2016. Paternalist populism and illiberal elitism in Central Europe. J. Polit. Ideol. 21, 9–25 https://doi.org/10.1080/13569317.2016.1105402.

European Commission, 2017, Commission decision of 6.3, 2017 on the measure/aid scheme/state aid S.A, 2015. 38454-2015/C (ex/N) which Hungary is planning to implement for supporting the development of two new nuclear reactors at Paks II nuclear power station.

European Commission, 2016a. Market legislation [WWW Document]. Energy. URL/energy/en/topics/markets-and-consumers/market-legislation (accessed 2.14.17).

European Commission, 2016b. Nuclear Illustrative Programme presented under Article 40 of the Euratom Treaty for the opinion of the European Economic and Social Committee (No. COM (2016) 177 final).

European Commission, 2015. Quarterly Report on European Electricity Markets (2014 q4). Directorate-General for Energy, Market Observatory for Energy of the European Commission. Brussels.

Eurostat, 2017. Supply, transformation and consumption of electricity - annual data.

Eurostat, 2016. Electricity production, consumption and market overview [WWW Document] Stat. Explain. URL ec.europa.eu/eurostat/statistics-explained/index.php/Electricity_production,_consumption_and_market_overview. (accessed 2.13.17).

Fazekas, M., Tóth, I.J., 2016. From Corruption to State Capture: A New Analytical Framework with Empirical Applications from Hungary. Polit. Res. Q. 69, 320–334 https://doi.org/10.1177/1065912916639137.

Felsmann, B., 2015. Működhet-e Paks 2 állami támogatás nélkül?. (Could Paks 2 work without state aid?.) Energiaklub. Budapest.

Fodor, B.E., 2012. A megújuló energia térnyerésének ösztönzési lehetőségei - A hazai kötelező átvételi rendszer értékelése (Promoting the use of renewable energies. An evaluation of the Hungarian feed-in tariff system) (PhD Thesis). Corvinus University of Budapest, Budapest.

Fouquet, D., Johansson, T.B., 2008. European renewable energy policy at crossroads—Focus on electricity support mechanisms. Energy Policy 36, 4079–4092 https://doi.org/10.1016/j.enpol.2008.06.023.

Foxon, T.J., 2011. A coevolutionary framework for analysing a transition to a sustainable low carbon economy. Ecol. Econ. 70, 2258–2267 https://doi.org/10.1016/j.ecolecon.2011.07.014.

Fredriksson, P.G., Vollebergh, H.R.J., Dijkgraaf, E., 2004. Corruption and energy efficiency in OECD countries: theory and evidence. J. Environ. Econ. Manag. 47,

207–231 https://doi.org/10.1016/j.jeem.2003.08.001.
Fuenfschilling, L., Truffer, B., 2014. The structuration of socio-technical regimes—Conceptual foundations from institutional theory. Res. Policy 43, 772–791 https://doi.org/10.1016/j.respol.2013.10.010.
GCP, 2016. Global Carbon Budget 2016. Global Carbon Project.
GEA, 2012. Global Energy Assessment: Toward a Sustainable Future. Cambridge University Press, Cambridge, UK and New York, USA.
Geels, F.W., 2018. Disruption and low-carbon system transformation: Progress and new challenges in socio-technical transitions research and the Multi-Level Perspective. Energy Res. Soc. Sci. 37, 224–231 https://doi.org/10.1016/j.erss.2017.10.010.
Geels, F.W., 2014. Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective. Theory Cult. Soc. 31, 21–40 https://doi.org/10.1177/0263276414531627.
Geels, F.W., 2011. The multi-level perspective on sustainability transitions: Responses to seven criticisms. Environ. Innov. Soc. Transit. 1, 24–40 https://doi.org/10.1016/j.eist.2011.02.002.
Geels, F.W., 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Res. Policy 31, 1257–1274 https://doi.org/10.1016/S0048-7333(02)00062-8.
Geels, F.W., Kern, F., Fuchs, G., Hinderer, N., Kungl, G., Mylan, J., Neukirch, M., Wassermann, S., 2016. The enactment of socio-technical transition pathways: A reformulated typology and a comparative multi-level analysis of the German and UK low-carbon electricity transitions (1990-2014). Res. Policy 45, 896–913 https://doi.org/10.1016/j.respol.2016.01.015.
Geels, F.W., Schot, J., 2007. Typology of sociotechnical transition pathways. Res. Policy 36, 399–417 https://doi.org/10.1016/j.respol.2007.01.003.
Geels, F.W., Sovacool, B.K., Schwanen, T., Sorrell, S., 2017. The Socio-Technical Dynamics of Low-Carbon Transitions. Joule 1, 463–479 https://doi.org/10.1016/j.joule.2017.09.018.
Geels, F.W., Verhees, B., 2011. Cultural legitimacy and framing struggles in innovation journeys: A cultural-performative perspective and a case study of Dutch nuclear energy (1945-1986). Technol. Forecast. Soc. Change 78, 910–930 https://doi.org/10.1016/j.techfore.2010.12.004.
Genus, A., Coles, A.-M., 2008. Rethinking the multi-level perspective of technological transitions. Res. Policy 37, 1436–1445 https://doi.org/10.1016/j.respol.2008.05.006.
Gilbert, A., Sovacool, B.K., Johnstone, P., Stirling, A., 2017. Cost overruns and financial risk in the construction of nuclear power reactors: A critical appraisal. Energy Policy 102, 644–649 https://doi.org/10.1016/j.enpol.2016.04.001.
Glachant, J.-M., Ruester, S., 2014. The EU internal electricity market: Done forever? Util. Policy 31, 221–228 https://doi.org/10.1016/j.jup.2014.03.006.
Grübler, A., 1996. Time for a change: on the patterns of diffusion of innovation. Daedalus 125, 19–42.
Hall, P.A., 1997. The Role of Interests Institutions, and Ideas in the Comparative Political Economy of the Industrialized Nations. In: Linchbach, M.I., Zuckerman, A.S. (Eds.), Comparative Politics: Rationality, Culture, and Structure. Cambridge University Press, New York.
Helm, D., 2002. Energy policy: security of supply, sustainability and competition. Energy Policy 30, 173–184.
Hermwille, L., 2016. The role of narratives in socio-technical transitions—Fukushima and the energy regimes of Japan. Germany, and the United Kingdom. Energy Res. Soc. Sci. 11, 237–246 https://doi.org/10.1016/j.erss.2015.11.001.
Hillman, A.J., Hitt, M.A., 1999. Corporate political strategy formulation: A model of approach, participation, and strategy decisions. Acad. Manage. Rev. 24, 825–842.
Howard, M.M., 2002. The Weakness of Postcommunist Civil Society. J. Democr. 13, 157–169 https://doi.org/10.1353/jod.2002.0008.
Hughes, L., Lipscy, P.Y., 2013. The Politics of Energy. Annu. Rev. Polit. Sci. 16, 449–469 https://doi.org/10.1146/annurev-polisci-072211-143240.
Hughes, L., Urpelainen, J., 2015. Interests, institutions, and climate policy: Explaining the choice of policy instruments for the energy sector. Environ. Sci. Policy 54, 52–63 https://doi.org/10.1016/j.envsci.2015.06.014.
Hungary Today, 2018. Hungarian Govt Sides with Car Industry Against Environmental Targets. Hung. Today. URL https://hungarytoday.hu/hungarian-govt-sides-with-car-industry/ (accessed 10.19.18).
IEA, 2017a. World Energy Balances. IEA World Energy Statistics and Balances (database).
IEA, 2017b. Extended World Energy Balances. IEA World Energy Statistics and Balances (database).
IEA, 2016. Medium-Term Renewable Energy Market Report 2016. OECD/IEA, Paris, France.
Index, 2016. Csepreghy: a szélenergiának nincs helye a magyar energiarendszerben (Csepreghy: wind energy has no place in the Hungarian energy sytem) [WWW Document]. Index - Belf. URL index.hu/belfold//10/08/csepreghy_a_szelenergianak_nincs_helye_a_magyar_energiarendszerben/. (accessed 2.14.17).
Innes, A., 2015. Hungary's Illiberal Democracy. Curr. Hist. 114, 95–100.
IRENA, 2015. Renewable Power Generation Costs in 2014. International Renewable Energy Agency.
Kádár, P., 2017. Folyamatok a hazai villamosenergia-iparban (Changes in the Hungarian power industry). Acta Wekerleensis 2017/1, 1–16.
Kaderják, P., 2011. The promotion of renewable energy supply (RES) in Hungary. Presentation at the Inogate Training in Budapest.
KEH, 2015. A közös hibát közösen kell helyrehoznunk–Áder János köztársasági elnök levele a parlamenti pártok frakcióvezetőihez (“The mistake we have committed together has to be remedied together” - Letter from President János Áder to the leaders of all parties in the Parliament), 14 January.
Kern, F., 2011. Ideas Institutions, and Interests: Explaining Policy Divergence in Fostering ‘System Innovations’ towards Sustainability. Environ. Plan. C Gov. Policy 29, 1116–1134 https://doi.org/10.1068/c1142.
Kilinc-Ata, N., 2016. The evaluation of renewable energy policies across EU countries and US states: An econometric approach. Energy Sustain. Dev. 31, 83–90 https://doi.org/10.1016/j.esd.2015.12.006.
Kiss, V.M., Hetesi, Z., Kiss, T., 2016. Issues and solutions relating to Hungary's electricity system. Energy 116, 329–340 https://doi.org/10.1016/j.energy.2016.09.121.
Kornai, J., 2015. Hungary'S U-Turn. Soc. Econ 37. pp. 279–329. https://doi.org/10.1556/204.2015.37.3.
Körösényi, A., 2005. Political Representation in Leader Democracy. Gov. Oppos. 40, 358–378 https://doi.org/10.1111/j.1477-7053.2005.00155.x.
Kovács, Á., 2009. Csukott szemmel bólintottak rá a paksi bővítésre (Expansion of Paks NPP blindly approved) [WWW Document]. origo.hu/. URL origo.hu/itthon/20091030-a-paksi-atomeromu-bovitese.html. (accessed 9.5.17).
Krekó, P., Enyedi, Z., 2018. Orbán's Laboratory of Illiberalism. J. Democr. 29, 39–51 https://doi.org/10.1353/jod.2018.0043.
Lechtenböhmer, S., Prantner, M., Schneider, C., Fülöp, O., Sáfián, F., 2016. Alternative and Sustainable Energy Scenarios for Hungary. Wuppertal Institute for Climate and Energiaklub Climate Policy Institute, Budapest.
Levy, D.L., Newell, P.J., 2002. Business Strategy and International Environmental Governance: Toward a Neo-Gramscian Synthesis. Glob. Environ. Polit. 2, 84–101 https://doi.org/10.1162/152638002320980632.
Locatelli, G., Mariani, G., Sainati, T., Greco, M., 2017. Corruption in public projects and megaprojects: There is an elephant in the room! Int. J. Proj. Manag. 35, 252–268 https://doi.org/10.1016/j.ijproman.2016.09.010.
Mahoney, J., Goertz, G., 2004. The Possibility Principle: Choosing Negative Cases in Comparative Research. Am. Polit. Sci. Rev. 98, 653–669 https://doi.org/10.1017/S0003055404041401.
Markandya, A., Wilkinson, P., 2007. Electricity generation and health. The Lancet 370, 979–990 https://doi.org/10.1016/S0140-6736(07)61253-7.
Marques, A.C., Fuinhas, J.A., Pires Manso, J.R., 2010. Motivations driving renewable energy in European countries: A panel data approach. Energy Policy, Energy Efficiency Policies and Strategies with regular papers. 38, 6877–6885 https://doi.org/10.1016/j.enpol.2010.07.003.
Martino, F., 2015. Green energy in Bulgaria: an uneasy success [WWW Document]. Oss. Balcani E Caucase Transeuropa. URL balcanicaucaso.org/eng/Areas/Bulgaria/Green-energy-in-Bulgaria-an-uneasy-success-158848. (accessed 2.14.17).
MAVIR, 2016a. A magyar villamosenergia-rendszer fogyasztói igényeinek előrejelzése 2016 (Demand projection in the Hungarian power system 2016) (No. MAVIR-RTO-DOK-0015-00-2016-10-03). Budapest.
MAVIR, 2016b. A Magyar Villamosenergia-rendszer közép- és hosszú távú forrásoldali kapacitásfejlesztése 2016 (Middle and long term supply side capacity development plan of the Hungarian power system 2016) (No. MAVIR-RTO-DOK-0014-00-2016-10-03). Budapest.
MAVIR, 2015. Data of the Hungarian electricity system. MAVIR Hungarian Independent Transmission Operator Company Ltd., Budapest.
Meadowcroft, J., 2009. What about the politics? Sustainable development, transition management, and long term energy transitions. Policy Sci. 42, 323–340 https://

doi.org/10.1007/s11077-009-9097-z.
MEKH, 2016a. A lakossági villamos energia és földgázárak nemzetközi összehasonlító vizsgálata 2016. szeptember (International comparison of household gas and electricity prices, September 2016). Hungarian Energy and Public Utility Regulatory Authority (MEKH), Budapest.
MEKH, 2016b. Összefoglaló a nem engedélyköteles kiserőművek adatairól (2008-2015) (Overview of data on small, non-licensed power stations (2008-2015)). Hungarian Energy and Public Utility Regulatory Authority (MEKH), Budapest.
MEKH, 2015. Household Energy Price Index for Europe. Hungarian Energy and Public Utility Regulatory Authority (MEKH), Energie-Control Austria. VaasaETT.
mmonline, 2015. Ezt a trend a hazai neten (sic) (These are the trends of the domestic internet) [WWW Document]. Marketing&Media. URL mmonline.hu/cikk/ezt_a_trend_a_hazai_neten. (accessed 2.14.17).
mmonline, 2013. Erre kattintanak a magyar netezők (This is what Hungarian internet users click on) [WWW Document]. Marketing&Media. URL mmonline.hu/cikk/erre_kattintanak_a_magyar_netezok. (accessed 2.14.17).
Morris, C., Jungjohann, A., 2016. From Meitner to Merkel: A History of German Nuclear Power, in: Energy Democracy. Palgrave Macmillan, Cham 299–339 https://doi.org/10.1007/978-3-319-31891-2_12.
Munoz, L.A.H., Huijben, J.C.C.M., Verhees, B., Verbong, G.P.J., 2014. The power of grid parity: A discursive approach. Technol. Forecast. Soc. Change 87, 179–190 https://doi.org/10.1016/j.techfore.2013.12.012.
Newell, P., Paterson, M., 1998. A climate for business: global warming, the state and capital. Rev. Int. Polit. Econ. 5, 679–703 https://doi.org/10.1080/096922998347426.
NFM, 2012. Nemzeti Energiastratégia 2030 (National Energy Strategy 2030), Ministry of National Development (NFM). Budapest.
NFM, 2011. Magyarország Megújuló Energia Hasznosítási Cselekvési Terve 2010-2020. Ministry of National Development (NFM), Budapest.
Noothout, P., de Jager, D., Tesnière, L., van Rooijen, S., Karypidis, N., Brückmann, R., Jirouš, F., Breitschopf, B., Angelopoulos, D., Doukas, H., Konstantinavičiūtė, I., Resch, G., 2016. The impact of risks in renewable energy investments and the role of smart policies (No. DiaCore. IEE/12/833/SI2.645735). Ecofys.
Nuttall, W.J., 2004. Nuclear Renaissance: Technologies and Policies for the Future of Nuclear Power. CRC Press, Boca Raton, Florida. USA.
Ondřich, J., 2016. Why haven't Central and Eastern European policy makers embraced the Energiewende? Energy Transit. URL https://energytransition.org/2016/11/why-cee-policy-makers-have-not-embraced-energiewende-2/. (accessed 2.14.17).
Origo, 2014. Megéri vagy sem az új atomerőmű? (Does it worth to build the new nuclear power plant?.) [WWW Document]. origo.hu. URL origo.hu/kornyezet/-mta-paks-bovites-konferencia-megterules-nincs-egyetertes-a-paksi-bovites-legfontosabb-szamairol.html. (accessed 2.14.17).
Origo, 2012. Öt ajánlat érkezhet a paksi atomerőmű bővítésére (Five offers might be made for the expansion of the Paks nuclear power plant) [WWW Document]. origo.hu/. URL origo.hu/itthon/20120605-ot-ajanlat-erkezhet-a-paksi-atomeromu-bovitesere.html. (accessed 9.5.17).
Origo, 2011a. A tiszta és olcsó árammal indokolja a kormányzat a paksi bővítést (Government justifies Paks nuclear expansion with clean and cheap electricity) [WWW Document]. origo.hu/. URL origo.hu/idojaras/-nem-engedheti-meg-maganak-az-atomstopot-magyarorszag-interju-a.html. (accessed 9.5.17).
Origo, 2011b. Az atomenergia már döglődő technológia" - Az Energiaklub Paks II-ről ("Nuclear is a dying technology. Energiaklub on Paks II) [WWW Document]. origo.hu/. URL origo.hu/idojaras/20111205-olyan-lesz-paks-ii-mint-a-negyes-metro-interju.html. (accessed 9.5.17).
Popp, D., Hascic, I., Medhi, N., 2011. Technology and the diffusion of renewable energy. Energy Econ., Special Issue on The Economics of Technologies to Combat Global Warming 33, 648–662 https://doi.org/10.1016/j.eneco.2010.08.007.
Reiche, D., 2006. Renewable energies in the EU-Accession States. Energy Policy. Renewable Energy Policies in the European UnionRenewable Energy Policies in the European Union 34, 365–375 https://doi.org/10.1016/j.enpol.2004.08.006.
Reiche, D., Bechberger, M., 2004. Policy differences in the promotion of renewable energies in the EU member states. Energy Policy 32, 843–849 https://doi.org/10.1016/S0301-4215(02)00343-9.
REN21, 2017. Renewables 2017: Global Status Report. REN21 Secretariat, Paris. France.
Roberts, D., 2015. The International Energy Agency consistently underestimates wind and solar power. Why?. [WWW Document]. Vox. URL https://www.vox.com/2015/10/12/9510879/iea-underestimate-renewables. (accessed 11.28.17).
Romano, A.A., Scandurra, G., 2016. Nuclear" and "nonnuclear" countries: Divergences on investment decisions in renewable energy sources. Energy Sources Part B Econ. Plan. Policy 11, 518–525 https://doi.org/10.1080/15567249.2012.714843.
Rosenbloom, D., Berton, H., Meadowcroft, J., 2016. Framing the sun: A discursive approach to understanding multi-dimensional interactions within socio-technical transitions through the case of solar electricity in Ontario. Canada. Res. Policy 45, 1275–1290 https://doi.org/10.1016/j.respol.2016.03.012.
Rothschild, 2015. Economic analysis for the Paks II nuclear power project - A rational investment case for Hungarian State resources (Report commissioned by the Prime Minister's Office of the Hungarian Government).
Rotmans, J., Kemp, R., van Asselt, M., 2001. More evolution than revolution: transition management in public policy. Foresight 3, 15–31 https://doi.org/10.1108/14636680110803003.
Schimmelfennig, F., 2007. European Regional Organizations. Political Conditionality, and Democratic Transformation in Eastern Europe. East Eur. Polit. Soc. 21, 126–141 https://doi.org/10.1177/0888325406297131.
Skjærseth, J.B., 2016. Linking EU climate and energy policies: policy-making, implementation and reform. Int. Environ. Agreem. Polit. Law Econ. 16, 509–523 https://doi.org/10.1007/s10784-014-9262-5.
Skovgaard, J., 2014. EU climate policy after the crisis. Environ. Polit. 23, 1–17 https://doi.org/10.1080/09644016.2013.818304.
Smink, M.M., Hekkert, M.P., Negro, S.O., 2015. Keeping sustainable innovation on a leash? Exploring incumbents' institutional strategies. Bus. Strategy Environ. 24, 86–101 https://doi.org/10.1002/bse.1808.
Smith, A., Voß, J.-P., Grin, J., 2010. Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. Res. Policy, Special Section on Innovation and Sustainability Transitions 39, 435–448 https://doi.org/10.1016/j.respol.2010.01.023.
Sorrell, S., Dimitropoulos, J., 2008. The rebound effect: Microeconomic definitions, limitations and extensions. Ecol. Econ. 65, 636–649 https://doi.org/10.1016/j.ecolecon.2007.08.013.
Šúri, M., Huld, T.A., Dunlop, E.D., Ossenbrink, H.A., 2007. Potential of solar electricity generation in the European Union member states and candidate countries. Sol. Energy 81, 1295–1305 https://doi.org/10.1016/j.solener.2006.12.007.
Szabó, A., 2018. Paks 2: This is what it looks like when influential people are positioning themselves around the project. Direkt36. [WWW Document]. direkt36.hu/. URL https://www.direkt36.hu/en/ilyen-az-amikor-befolyasos-figurak-probalnak-helyezkedni-paks-2-korul/. (accessed 4.12.19).
Szabó, A., 2017. The mysterious German behind Orban's Russian deals. [WWW Document]. direkt36.hu/. URL https://www.direkt36.hu/en/a-rejtelyes-nemet-aki-orban-orosz-manovereit-egyengeti/. (accessed 4.12.19).
Tchalakov, I., Hristov, I., Mitev, T., 2011. The Black Hole of Bulgarian Power Industry - Transformation of Electric Power Sector in Bulgaria after 1989. East-West Publishers, Sofia.
Teleszkóp, 2016. A villamosenergia-szolgáltatással kapcsolatos felhasználói elégedettség mérésének. évi eredményei (Results on consumer satisfaction with electricity services in 2015) (Report commissioned by MEKH (Magyar Energetikai és Közmű-szabályozási Hivatal)). Teleszkóp Üzleti Tanácsadó és Piackutató Kft., Budapest.
Temple, J., 2018. At this rate, it's going to take nearly 400 years to transform the energy system [WWW Document]. MIT Technol. Rev. URL https://www.technologyreview.com/s/610457/at-this-rate-its-going-to-take-nearly-400-years-to-transform-the-energy-system/. (accessed 11.1.18).
Teräväinen, T., 2018. Visions of energy futures. Nat. Energy 1 https://doi.org/10.1038/s41560-018-0279-9.
Unruh, G.C., 2000. Understanding carbon lock-in. Energy Policy 28, 817–830 https://doi.org/10.1016/S0301-4215(00)00070-7.
Valentine, S.V., 2011. Emerging symbiosis: Renewable energy and energy security. Renew. Sustain. Energy Rev. 15, 4572–4578 https://doi.org/10.1016/j.rser.2011.07.095.
Verbong, G., Geels, F., 2007. The ongoing energy transition: Lessons from a socio-technical, multi-level analysis of the Dutch electricity system (1960-2004). Energy Policy 35, 1025–1037 https://doi.org/10.1016/j.enpol.2006.02.010.
Verbruggen, A., 2008. Renewable and nuclear power: A common future? Energy Policy, Transition towards Sustainable Energy Systems 36, 4036–4047 https://doi.org/10.1016/j.enpol.2008.06.024.

Von Hirschhausen, C., Waelde, T.W., 2001. The end of transition: an institutional interpretation of energy sector reform in Eastern Europe and the CIS. MOST Econ. Policy Transitional Econ. 11, 93–110.
Williams, J.H., DeBenedictis, A., Ghanadan, R., Mahone, A., Moore, J., Morrow, W.R., Price, S., Torn, M.S., 2012. The Technology Path to Deep Greenhouse Gas Emissions Cuts by 2050: The Pivotal Role of Electricity. Science 335, 53–59 https://doi.org/10.1126/science.1208365.
Wilson, C., Grubler, A., 2011. Lessons from the history of technological change for clean energy scenarios and policies. Nat. Resour. Forum 35, 165–184 https://doi.org/10.1111/j.1477-8947.2011.01386.x.
Wirth, H., 2017. Recent facts about photovoltaics in Germany. Fraunhofer Institute for Solar Energy Systems ISE. Freiburg.
Zakaria, F., 1997. The rise of illiberal democracy. Foreign Aff. 76, 22–43.